

APPENDIX A

Additional Model Results

- Table A-1. Calculation of Emissions Degradation Factors for the Baseline Case
- Table A-2. Emission and Fuel Consumption Factors for the Baseline Case:
g/BHP-hr
- Table A-3. Emission and Fuel Consumption Factors for the Baseline Case:
g/mile
- Table A-4. Estimated Annual VMT by Year and Vehicle Class by Region
- Table A-5. Baseline, Total, and Excess Emissions Statewide by Vehicle Class

TABLE A-1. CALCULATION OF EMISSIONS DEGRADATION FACTORS FOR THE BASELINE CASE

Heavy-Hd Duty Trucks		California Registered		Frequency of Defect Occurrence		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor										
Type of Defect	1980-1987	1988-1993	1994-1997	1998-1993	1999-1993	1990-1993	1991-1993	1992-1993	1993-1993	1994-1993	1995-1993	1996-1993	1997-1993	1998-1993	1999-1993	1994-1993	1995-1993	1996-1993	1997-1993	1998-1993	Oxides of Nitrogen	Unburned Hydrocarbons
1 Timing Advanced	10%	20%	5%	70%	50%	80%	11.2%	10.0%	3.0%	3.0%	0%	0%	30%	30%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	1.5%
2 Timing Retarded	12%	10%	3%	-20%	-20%	-20%	-2.4%	-2.0%	-0.6%	-0.6%	50%	50%	50%	50%	8.0%	8.0%	5.0%	5.0%	1.5%	1.5%	1.5%	1.5%
3 Minor Inj. Problems	20%	18%	10%	10%	10%	10%	0%	0%	0.0%	0.0%	10%	10%	10%	10%	2.0%	2.0%	1.6%	1.6%	3.0%	3.0%	3.0%	3.0%
4 Mod. Inj. Problems	16%	13%	10%	-6%	-6%	-5%	-5%	-5%	-0.5%	-0.5%	160%	160%	160%	160%	300%	300%	22.5%	22.5%	30.0%	30.0%	30.0%	30.0%
5 Severe Inj. Problem	4%	4%	4%	-10%	-10%	-10%	-10%	-10%	-0.4%	-0.4%	600%	600%	600%	600%	1100%	1100%	20.0%	20.0%	44.0%	44.0%	44.0%	44.0%
6 Puff Lt./er Missat	28%	21%	2%	0%	0%	0%	0%	0%	0.0%	0.0%	0%	0%	0%	0%	0.5%	0.5%	0.5%	0.5%	0.0%	0.0%	0.0%	0.0%
7 Puff Lt./er Disabled	30%	23%	6%	0%	0%	0%	0%	0%	0.0%	0.0%	-20%	-20%	-20%	-20%	0%	0%	-0.0%	-0.0%	-4.6%	-4.6%	0.0%	0.0%
8 Maximum Fuel High	24%	18%	3%	3%	10%	10%	10%	2.4%	1.0%	0.3%	0.3%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
9 Clogged Air Filter	22%	15%	8%	8%	8%	8%	0%	0%	0.0%	0.0%	0%	0%	0%	0%	0.5%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10 Wrong/Burn Turbo	12%	10%	5%	0%	0%	0%	0%	0%	0.0%	0.0%	0%	0%	0%	0%	0.5%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
11 Intake/Exh Clogged	3%	7%	5%	20%	20%	20%	2.6%	1.4%	1.3%	1.3%	-20%	-20%	-20%	-20%	-20%	-20%	-0.6%	-0.6%	-1.0%	-1.0%	-1.0%	-1.0%
12 Other Air Problems	16%	15%	6%	6%	6%	6%	0%	0%	0.0%	0.0%	0%	0%	0%	0%	0.5%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
13 Engine Mech. Failur	2%	2%	2%	-10%	-10%	-10%	-10%	-10%	-0.2%	-0.2%	200%	200%	200%	200%	500%	500%	4.0%	4.0%	8.0%	8.0%	10.0%	10.0%
14 Excess Oil Cons.	5%	5%	5%	0%	0%	0%	0%	0%	0.0%	0.0%	300%	300%	300%	300%	300%	300%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
15 Electronics Failed	0%	2%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0%	0%	0%	0%	30%	30%	0.0%	0.0%	0.0%	0.0%	2.5%	2.5%
16 Electronics Tempere	0%	5%	10%	0%	5%	5%	80%	80%	2.0%	12.0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
17 Catalyst Removed	0%	0%	6%	0%	0%	0%	0%	0%	0.0%	0.0%	0%	0%	0%	0%	100%	100%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
18 Trap Removed	0%	0%	4%	40%	0%	0%	0%	0%	0.0%	0.0%	0%	0%	0%	0%	40%	100%	0.0%	0.0%	1.6%	4.0%	4.0%	4.0%
19 EGR Disabled	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
% Increase Due to All Defects Combined																						
10.6% 12.7% 15.0%																						

A-1

[Continued]

62.3% 58.5% 114.5% 163.5%

TABLE A-1. [Continued]

Type of Defect	California Registered Engines										Heavy-Hd Duty Trucks										Fuel Consumption					
	Frequency of Defect Occurrence Among Trucks in this Class					% Change in Individual Vehicle Emission Factor					% Change in Fleet-Average Emission Factor					% Change in Individual Vehicle Emission Factor					% Change in Fleet-Average Emission Factor					
	1980-1987	1988-1990	1991-1993	1994-1995	1996-1997	1998-1999	1991-1993	1994-1995	1996-1997	1998-1999	1991-1993	1994-1995	1996-1997	1998-1999	1991-1993	1994-1995	1996-1997	1998-1999	1991-1993	1994-1995	1996-1997	1998-1999	1991-1993	1994-1995	1996-1997	1998-1999
1 Timing Advanced	18%	21%	1%	6%	5%	-25%	-30%	0%	0%	-4.0%	-4.0%	0.0%	0.0%	-7%	-4%	-3%	-3%	-1.1%	-0.8%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%
2 Timing Retarded	12%	10%	1%	3%	5%	25%	100%	6.0%	2.5%	3.0%	3.0%	10.6%	10.6%	2%	2%	2%	2%	0.4%	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
3 Minor Inj. Problems	20%	18%	1.0%	1.0%	1.0%	31%	70%	70%	7.0%	6.3%	10.6%	10.6%	2%	2%	2%	2%	0.4%	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	
4 Mod. Inj. Problems	10%	13%	1.0%	2.0%	2.0%	40%	400%	400%	30.0%	26.0%	40.0%	40.0%	6%	6%	6%	6%	0.6%	0.7%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	
5 Severe Inj. Problems	4%	4%	4%	4%	4%	70%	70%	160%	420%	28.0%	28.0%	60.0%	60.0%	10%	10%	10%	10%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	
6 Puff Litter Misset	2%	21%	2%	0%	20%	20%	60%	60%	6.0%	4.2%	1.0%	0.0%	1%	1%	1%	1%	0.3%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
7 Puff Litter Disabled	3%	23%	0%	6%	60%	60%	100%	100%	15.0%	11.5%	5.0%	0.0%	2%	2%	2%	2%	0.6%	0.5%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
8马克思 Fuel High	24%	18%	3%	3%	20%	30%	30%	4.8%	5.4%	0.9%	0.9%	2%	2%	2%	2%	0.5%	0.4%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%		
9 Clogged Air Filter	22%	16%	6%	8%	40%	40%	60%	60%	8.8%	6.0%	4.0%	4.0%	2%	2%	2%	2%	0.4%	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%		
10 Wrong/Norm Turbo	12%	5%	5%	40%	40%	50%	50%	4.8%	4.0%	2.6%	2.6%	2%	2%	2%	2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%			
11 Intercooler Clogged	3%	7%	3%	40%	40%	60%	60%	1.2%	2.8%	2.8%	2.8%	2%	2%	2%	2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%			
12 Other Air Problems	10%	16%	8%	40%	40%	40%	40%	6.0%	6.0%	3.2%	3.2%	1%	1%	1%	1%	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%			
13 Engine Mech. Failure	2%	2%	2%	150%	150%	300%	300%	6.0%	7.0%	15.0%	30.0%	0%	0%	0%	0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%			
14 Excess Oil Cons.	5%	5%	5%	120%	150%	300%	300%	0.0%	0.0%	9.0%	120.0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
15 Electronics Failed	0%	2%	5%	0%	30%	60%	60%	0.0%	0.0%	3.0%	3.0%	0%	0%	3%	3%	0.0%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%			
16 Electronics Tempers	0%	0%	15%	0%	0%	50%	50%	0.0%	0.0%	7.6%	7.6%	0%	0%	-6%	-6%	0.0%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%			
17 Catalyst Removed	0%	0%	6%	0%	0%	40%	40%	0%	0%	2.4%	0.0%	0%	0%	-1%	-1%	0.0%	0.0%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%			
18 Trap Removed	0%	0%	0%	40%	0%	0%	0%	0%	0%	0.0%	0.0%	0%	0%	-3%	-3%	0.0%	0.0%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%			
19 EGR Disabled	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
% Increased Due to All Defects Combined																										
163.4%																										
130.6%																										
208.4%																										
536.6%																										

[Continued]

TABLE A-1. (Continued)

Type of Defect	Heavy-Hd Duty Trucks										Unburned Hydrocarbons										Heavy-Hd Duty Trucks														
	California Registered Federal Engines					Frequency of Defect Occurrence Among Trucks in this Class					% Change in Individual Vehicle Emission Factor					% Change in Fleet-Average Emission Factor					% Change in Individual Vehicle Emission Factor					% Change in Fleet-Average Emission Factor									
	1980-1983	1984-1985	1986-1987	1988-1989	1990-1991	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	1980-1983	1984-1985	1986-1987	1988-1989	1990-1991	1992-1993	1994-1995	1996-1997	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004			
1 Timing Advanced	8%	12%	5%	5%	50%	50%	80%	80%	40%	60%	30%	20%	20%	20%	20%	20%	20%	20%	20%	30%	30%	1.6%	2.4%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%				
2 Timing Retarded	15%	10%	3%	3%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%			
3 Minor Inj. Problems	20%	18%	16%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
4 Mod. Inj. Problems	12%	10%	8%	8%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	15.0%	30.0%	18.0%	15.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%			
5 Severe Inj. Problems	3%	3%	3%	3%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	50.0%	110.0%	110.0%	15.0%	33.0%	33.0%	33.0%	33.0%	33.0%	33.0%			
6 Puff Lt'er Misest	20%	21%	2%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
7 Puff Lt'er Disabled	30%	23%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
8 Maximum Fuel High	24%	18%	3%	3%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%			
9 Clogged Air Filter	18%	14%	8%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
10 Wrong/Harm Turbo	11%	8%	5%	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
11 Intercooler Clogged	3%	7%	5%	5%	10%	20%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%				
12 Other Air Problem	13%	15%	8%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
13 Engine Mech. Failur	1%	1%	1%	1%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	20.0%	20.0%	20.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%			
14 Excess Oil Cons.	4%	4%	4%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
15 Electronics Failed	0%	1%	3%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
16 Electronics Tempre	0%	6%	20%	20%	30%	30%	80%	80%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
17 Catalyst Removed	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
18 Trap Removed	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
19 EGR Disabled	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
% Increase Due to All Defects Combined																																			
2.7%																																			
51.3%																																			
47.3%																																			
89.3%																																			
147.1%																																			

(Continued)

TABLE A-1. [Continued]

Type of Defect	Heavy-Hd Duty Trucks		California Registered Federal Engines		Frequency of Defect Occurrence Among Trucks in this Class		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		Fuel Consumption			
	1980-1987	1988-1993	1980-1987	1988-1993	Oward	1980-1987	1988-1993	Oward	1980-1987	1988-1993	Oward	1980-1987	1988-1993	Oward	1980-1987	1988-1993	Oward	
1 Timing Advanced	8%	12%	1%	5%	3%	10%	1%	0%	1.2%	0.0%	0%	-2%	-6%	-2%	-0.2%	-0.3%	-0.3%	
2 Timing Retarded	10%	10%	1%	3%	3%	30%	40%	100%	4.5%	4.0%	3.0%	7%	7%	10%	1.1%	0.7%	0.3%	
3 Minor Inj. Problems	20%	18%	18%	16%	30%	35%	70%	70%	7.0%	6.3%	10.6%	2%	2%	2%	0.4%	0.3%	0.3%	
4 Mod. Inj. Problems	12%	10%	8%	8%	20%	40%	400%	24.0%	24.0%	32.0%	5%	5%	5%	0.8%	0.6%	0.4%	0.4%	
5 Severe Inj. Problem	3%	3%	3%	3%	70%	70%	1500%	4200%	21.0%	45.0%	128.0%	10%	10%	10%	0.3%	0.3%	0.3%	
6 Puff Lt*er Missat	20%	21%	2%	0%	20%	20%	60%	60%	6.6%	4.2%	1.0%	0.0%	1%	1%	0.3%	0.2%	0.0%	
7 Puff Lt*er Disabled	30%	23%	8%	0%	50%	50%	100%	15.0%	11.6%	5.0%	0.0%	2%	2%	2%	0.8%	0.6%	0.1%	
8 Maximum Fuel High	24%	18%	3%	3%	20%	20%	4.0%	3.8%	0.6%	0.6%	2%	2%	2%	2%	0.5%	0.4%	0.1%	
9 Clogged Air Filter	18%	14%	8%	8%	40%	40%	50%	50%	7.2%	5.8%	4.0%	4.0%	2%	2%	0.4%	0.3%	0.2%	
10 Wrong/Horn Turbo	11%	8%	5%	5%	40%	40%	50%	50%	4.4%	3.6%	2.5%	1%	1%	1%	0.1%	0.1%	0.1%	
11 Intercooler Clogged	3%	7%	5%	5%	40%	40%	50%	50%	1.2%	2.8%	2.8%	2%	2%	2%	0.1%	0.1%	0.1%	
12 Other Air Problems	13%	15%	8%	8%	40%	40%	40%	40%	5.2%	6.0%	3.2%	1%	1%	1%	0.2%	0.1%	0.1%	
13 Engine Keph. Failur	1%	1%	1%	1%	150%	150%	300%	300%	1.5%	1.5%	3.0%	7%	7%	9%	0.1%	0.1%	0.1%	
14 Excess Oil Cans.	4%	4%	4%	4%	150%	150%	300%	300%	8.0%	8.0%	12.0%	0%	0%	0%	0.0%	0.0%	0.0%	
15 Electronics Failed	0%	1%	3%	3%	0%	30%	60%	60%	0.0%	0.3%	1.6%	0%	3%	3%	0.0%	0.1%	0.1%	
16 Electronics Tempore	0%	6%	20%	20%	0%	0%	50%	50%	0.0%	0.0%	10.0%	0%	0%	-5%	0.0%	-1.0%	-1.0%	
17 Catalyst Removed	0%	0%	6%	0%	0%	0%	40%	0%	0.0%	0.0%	2.4%	0.0%	0%	-1%	0.0%	-0.1%	0.0%	
18 Trap Removed	0%	0%	6%	0%	0%	0%	0%	200%	300%	0.0%	0.0%	150.0%	0%	0%	-3%	0.0%	-0.2%	-1.5%
19 EGR Disabled	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0%	0%	0%	0.0%	0.0%	0.0%	
% Increased Due to All Defects Combined																		
															4.5%	3.4%	0.6%	
																	-0.3%	

(Continued)

TABLE A-1. [Continued]

Type of Defect	Heavy-Hd Duty Trucks Out-of-State Registered		Frequency of Defect Occurrence Among Trucks in this Class		X Change in Individual Vehicle Emission Factor		X Change in Fleet-Average Emission Factor		Oxides of Nitrogen		Unburned Hydrocarbons		
	Federal Engines		Among Trucks in this Class		1980-1984- 1981-1983 Outward		1984- 1985-1987 Outward		1985-1986- 1987-1989 Outward		1988-1989- 1990-1992 Outward		
	1980-1987	1980-1983	1981-1987	1980-1983	1981-1987	1980-1983	1981-1987	1980-1983	1981-1987	1980-1983	1981-1987	1980-1983	1981-1987
1 Timing Advanced	6%	12%	6%	6%	50%	50%	80%	80%	4.0%	8.0%	3.0%	20%	20%
2 Timing Retarded	16%	10%	3%	3%	-20%	-20%	-20%	-20%	-0.6%	-0.6%	50%	50%	50%
3 Minor Inj. Problem	20%	18%	10%	10%	0%	0%	0%	0%	0.0%	0.0%	10%	10%	10%
4 Mod. Inj. Problem	6%	4%	4%	4%	-5%	-5%	-5%	-5%	-0.2%	-0.2%	150%	150%	150%
5 Severe Inj. Problem	1%	1%	1%	1%	-10%	-10%	-10%	-10%	-0.1%	-0.1%	500%	500%	500%
6 Puff Litter Missat	2%	2%	2%	2%	0%	0%	0%	0%	0.0%	0.0%	0%	0%	0%
7 Puff Litter Disabled	30%	2%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	-20%	0%	0%
8 Maximum Fuel High	24%	18%	3%	3%	10%	10%	10%	10%	2.4%	1.8%	0.3%	0%	0%
9 Clogged Air Filter	15%	13%	6%	6%	0%	0%	0%	0%	0.0%	0.0%	0%	0%	0%
10 Wrong/Worn Turbo	10%	6%	6%	6%	0%	0%	0%	0%	0.0%	0.0%	0%	0%	0%
11 Intercooler Clogged	3%	7%	5%	5%	20%	25%	25%	25%	1.4%	1.3%	-20%	-20%	-20%
12 Other Air Problems	10%	15%	8%	8%	0%	0%	0%	0%	0.0%	0.0%	0%	0%	0%
13 Engine Mech. Failure	1%	1%	1%	1%	-10%	-10%	-10%	-10%	-0.1%	-0.1%	200%	200%	200%
14 Excess Oil Cons.	3%	3%	3%	3%	0%	0%	0%	0%	0.0%	0.0%	300%	300%	300%
15 Electronics Failed	0%	1%	3%	3%	0%	0%	0%	0%	0.0%	0.0%	50%	50%	50%
16 Electronics Tempere	0%	8%	20%	20%	0%	30%	80%	80%	1.8%	1.8%	0%	0%	0%
17 Catalyst Removed	0%	0%	6%	0%	0%	0%	0%	0%	0.0%	0.0%	100%	0%	0%
18 Trap Removed	0%	0%	6%	0%	0%	0%	0%	0%	0.0%	0.0%	40%	100%	0%
19 EGR Disabled	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0%	0.0%	0.0%
X Increase Due to All Defects Combined													
					3.1%	8.7%	19.6%	19.6%				32.2%	28.2%
												61.5%	103.5%

% Increase Due to All Defects Combined

(Continued)

TABLE A-1. (Continued)

Type of Defect	Heavy-Hd Duty Trucks Out-of-State Registered		Frequency of Defect Occurrence Among Trucks in this Class		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		Fuel Consumption						
	1980- 1987	1988- 1990	1991- 1993	1994- 1997	1990- 1997	1991- 1993	1992- 1993	1993- 1997	1990- 1997	1991- 1993	1992- 1993	1993- 1997	1990- 1997	1991- 1993	1992- 1993				
1 Timing Advanced	8%	12%	15%	6%	10%	9%	6%	0%	1.2%	0.0%	0.0%	-2%	-5%	-0.0%	-0.2%	-0.3%	-0.3%		
2 Timing Retarded	16%	10%	3%	3%	30%	40%	100%	4.6%	4.0%	3.0%	3.0%	7%	7%	10%	1.1%	0.7%	0.3%	0.3%	
3 Minor Inj. Problems	20%	18%	15%	15%	36%	36%	70%	7.0%	6.3%	10.5%	10.5%	2%	2%	2%	0.4%	0.4%	0.3%	0.3%	
4 Mod. Inj. Problems	8%	6%	4%	4%	20%	20%	40%	16.0%	16.0%	16.0%	16.0%	5%	5%	5%	0.4%	0.3%	0.2%	0.2%	
5 Severe Inj. Problems	1%	1%	1%	1%	70%	70%	150%	7.0%	7.0%	15.0%	15.0%	10%	10%	10%	0.1%	0.1%	0.1%	0.1%	
6 Puff Lt's or Misses	28%	21%	25%	0%	20%	20%	60%	6.0%	6.0%	4.2%	4.2%	1%	1%	1%	0.3%	0.2%	0.0%	0.0%	
7 Puff Lt's or Disabled	30%	35%	35%	0%	50%	50%	100%	15.0%	15.0%	11.0%	11.0%	5.0%	5.0%	2%	2%	0.6%	0.6%	0.0%	
8 Maximum Fuel High	2%	1%	3%	3%	20%	20%	20%	4.0%	3.0%	0.0%	0.0%	2%	2%	2%	0.5%	0.4%	0.1%	0.1%	
9 Clogged Air Filter	15%	15%	25%	25%	40%	50%	50%	6.0%	5.2%	4.0%	4.0%	2%	2%	2%	0.3%	0.3%	0.2%	0.2%	
10 Wrong/Worn Turbo	10%	8%	8%	8%	40%	50%	50%	4.0%	3.6%	2.5%	2.5%	1%	1%	1%	0.1%	0.1%	0.1%	0.1%	
11 Intercooler Clogged	3%	7%	15%	15%	40%	50%	50%	1.2%	2.6%	2.0%	2.0%	2%	2%	2%	0.1%	0.1%	0.1%	0.1%	
12 Other Air Problems	10%	15%	25%	25%	40%	40%	40%	4.0%	6.0%	3.2%	3.2%	1%	1%	1%	0.1%	0.2%	0.1%	0.1%	
13 Engine Mech. Failure	1%	1%	15%	15%	150%	300%	500%	1.0%	1.6%	3.0%	3.0%	7%	7%	6%	0.1%	0.1%	0.1%	0.1%	
14 Excess Oil Cons.	3%	3%	3%	3%	160%	300%	600%	4.6%	4.6%	9.0%	16.0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	
15 Electronics Failed	0%	1%	1%	1%	30%	60%	60%	0.0%	0.3%	1.0%	1.0%	0%	0%	3%	0.0%	0.0%	0.1%	0.1%	
16 Electronics Tempore	0%	6%	20%	20%	0%	6%	60%	0.0%	0.0%	10.0%	10.0%	0%	0%	-5%	-5%	0.0%	-1.0%	-1.0%	
17 Catalyst Removed	0%	0%	0%	0%	40%	0%	0%	0.0%	0.0%	2.4%	0.0%	0%	0%	-1%	0.0%	0.0%	-0.1%	0.0%	
18 Trap Removed	0%	0%	5%	5%	0%	0%	200%	0.0%	0.0%	10.0%	16.0%	0%	0%	-3%	0.0%	0.0%	-0.2%	-1.5%	
19 EGR Disabled	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	
% Increased Due to All Defects Combined																4.0%	3.0%	0.2%	-1.3%

(Continued)

TABLE A-1. (Continued)

MEDIUM-HEAVY DUTY TRUCKS		CALIFORNIA REGISTERED CALIFORNIA ENGINES		FREQUENCY OF DEFECT OCCURRENCE AMONG TRUCKS IN THIS CLASS		% CHANGE IN INDIVIDUAL VEHICLE EMISSION FACTOR		% CHANGE IN FLEET-AVERAGE EMISSION FACTOR		% CHANGE IN INDIVIDUAL VEHICLE EMISSION FACTOR		% CHANGE IN FLEET-AVERAGE EMISSION FACTOR		UNBURNED HYDROCARBONS					
TYPE OF DEFECT	1980-1987	1988-1990	1991-1993	1994-ONWARD	1980-1987	1988-1990	1991-1993	1994-ONWARD	1980-1987	1988-1990	1989-1993	1994-ONWARD	1980-1987	1988-1990	1989-1993	1994-ONWARD			
1 Timing Advanced	16%	16%	6%	6%	70%	60%	60%	10.5%	7.5%	3.0%	3.0%	0%	0%	30%	30%	0.0%	0.0%		
2 Timing Retarded	6%	6%	4%	4%	-20%	-20%	-20%	-1.2%	-1.0%	-0.8%	-0.8%	30%	20%	50%	50%	1.8%	1.0%		
3 Minor Inj. Problems	20%	16%	15%	15%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	10%	10%	20%	20%	2.0%	2.0%		
4 Mod. Inj. Problems	15%	13%	10%	10%	-6%	-6%	-6%	-0.8%	-0.7%	-0.5%	-0.5%	150%	150%	300%	300%	18.0%	30.0%		
5 Severe Inj. Problem	6%	6%	6%	6%	-10%	-10%	-10%	-0.5%	-0.5%	-0.5%	-0.5%	600%	600%	1100%	1100%	25.0%	55.0%		
6 Puff Lt'er Hicst	18%	13%	2%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%		
7 Puff Lt'er Disabled	16%	12%	4%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	-20%	-20%	0%	0%	-3.0%	-2.4%		
8 Maximum Fuel High	14%	10%	2%	2%	10%	10%	10%	1.4%	-1.0%	-0.2%	-0.2%	0%	0%	0%	0%	0.0%	0.0%		
9 Clogged Air Filter	23%	19%	10%	10%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%		
10 Wrong/Burn Turbo	10%	9%	5%	5%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%		
11 Intercooler Clogged	1%	4%	3%	3%	20%	20%	20%	0.2%	0.8%	0.8%	0.8%	-20%	-20%	-20%	-20%	-0.2%	-0.8%		
12 Other Air Problems	14%	12%	8%	8%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%		
13 Engine Mech. Failure	2%	2%	2%	2%	-10%	-10%	-10%	-0.2%	-0.2%	-0.2%	-0.2%	200%	200%	300%	300%	4.0%	4.0%		
14 Excess Oil Cons.	8%	6%	6%	6%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	300%	300%	300%	300%	24.0%	24.0%		
15 Electronics Failed	0%	2%	8%	8%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	4.0%	4.0%		
16 Electronics Tempere	0%	3%	10%	10%	0%	0%	0%	0.0%	1.5%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%		
17 Catalyst Removed	0%	0%	6%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%		
18 Trap Removed	0%	0%	9%	30%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	40%	100%	0.0%	3.6%		
19 EGR Disabled	0%	0%	3%	6%	0%	0%	0%	30%	36%	0.0%	0.0%	1.1%	2.1%	0%	16%	0.0%	0.0%		
																75.7%	72.3%	144.3%	175.3%

% INCREASE DUE TO ALL DEFECTS COMBINED

(Continued)

TABLE A-1. [Continued]

Type of Defect	Medium-Heavy Duty Trucks		California Registered California Engines		Frequency of Defect Occurrence Among Trucks in this Class		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		Fuel Consumption				
	1980-1987		1988-1993		1980-1987		1988-1993		1980-1987		1988-1993		1980-1987		1988-1993				
	1987	1990	1983	1987	1980	1987	1983	1987	1980	1987	1983	1987	1980	1987	1980	1987	1980	1987	
1 Timing Advanced	10%	10%	5%	5%	-20%	0%	0%	-3.0%	-3.0%	0.0%	0.0%	-7%	-4%	-5%	-6%	-1.1%	-0.6%	-0.3%	-0.3%
2 Timing Retarded	8%	5%	4%	4%	5%	20%	100%	3.0%	1.3%	4.0%	4.0%	7%	10%	10%	8.8%	0.4%	0.4%	0.4%	0.4%
3 Minor Inj. Problem	20%	10%	10%	10%	35%	35%	70%	7.0%	8.3%	10.6%	10.6%	2%	2%	2%	0.4%	0.4%	0.3%	0.3%	0.3%
4 Maj. Inj. Problem	10%	10%	10%	10%	20%	20%	400%	30.0%	28.0%	40.0%	40.0%	6%	6%	6%	0.3%	0.7%	0.5%	0.5%	0.6%
5 Severe Inj. Problem	5%	5%	5%	5%	500%	500%	1500%	25.0%	25.0%	70.0%	70.0%	10%	10%	10%	0.5%	0.5%	0.5%	0.5%	0.6%
6 Puff Litter Misest	10%	10%	10%	10%	20%	20%	50%	5.0%	3.6%	2.6%	2.6%	1%	1%	1%	0.2%	0.1%	0.1%	0.1%	0.0%
7 Puff Litter Disabled	10%	10%	10%	10%	50%	50%	100%	7.5%	8.0%	4.0%	4.0%	2%	2%	2%	0.3%	0.3%	0.1%	0.1%	0.0%
8 Maximum Fuel High	10%	10%	10%	10%	30%	30%	30%	4.2%	3.0%	0.8%	0.8%	2%	2%	2%	0.3%	0.2%	0.0%	0.0%	0.0%
9 Clogged Air Filter	20%	10%	10%	10%	50%	50%	50%	11.5%	9.8%	6.0%	6.0%	2%	2%	2%	0.6%	0.4%	0.2%	0.2%	0.2%
10 Wrong/Worn Turbo	10%	5%	5%	5%	40%	40%	50%	4.0%	3.0%	2.6%	2.6%	1%	1%	1%	0.1%	0.1%	0.1%	0.1%	0.1%
11 Intercooler Clogged	1%	4%	3%	3%	40%	40%	50%	0.4%	1.6%	1.6%	1.6%	2%	2%	2%	0.0%	0.1%	0.1%	0.1%	0.1%
12 Other Air Problem	10%	10%	8%	8%	40%	40%	40%	6.6%	4.0%	3.2%	3.2%	1%	1%	1%	0.1%	0.1%	0.1%	0.1%	0.1%
13 Engine Mech. Failure	2%	2%	2%	2%	160%	160%	300%	3.0%	3.0%	8.0%	10.0%	7%	7%	8%	0.1%	0.1%	0.1%	0.1%	0.1%
14 Excess Oil Loss	8%	8%	8%	8%	120%	120%	300%	9.6%	12.0%	24.0%	48.0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%
15 Electronics Failed	0%	2%	8%	8%	0%	30%	80%	0.0%	0.0%	4.6%	4.6%	0%	4%	4%	0.0%	0.1%	0.1%	0.1%	0.3%
16 Electronics Temp.	0%	3%	10%	10%	0%	0%	50%	0.0%	0.0%	5.0%	6.0%	0%	-6%	-6%	0.0%	-0.2%	-0.5%	-0.5%	-0.5%
17 Catalyst Removed	0%	0%	8%	8%	0%	0%	40%	0%	0.0%	0.0%	3.2%	0.0%	0%	-1%	0%	0.0%	-0.1%	0.0%	-0.1%
18 Trap Removed	0%	0%	8%	8%	30%	0%	0%	200%	300%	0.0%	0.0%	18.0%	30.0%	0%	0%	-0.4%	0.0%	-0.4%	-1.2%
19 EGR Disabled	0%	0%	3%	6%	0%	0%	10%	-10%	0.0%	0.0%	-0.8%	-0.8%	0%	1%	1%	0.0%	0.0%	0.1%	0.1%
% Increase Due to All Defects Combined																			
191.1%																			
118.7%																			
261.6%																			
535.1%																			

(Continued)

TABLE A-1. (Continued)

Type of Defect	Heavy-Hd Duty Trucks		California Registered Federal Engines		Frequency of Defect Occurrence Among Trucks in this Class		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		Unburned Hydrocarbons			
	1980-1987	1988-1993	1980-1987	1988-1993	1991-1993	Onward	1980-1987	1988-1990	1991-1993	Onward	1980-1987	1988-1990	1981-1993	Onward	1980-1987	1988-1990	1981-1993	Onward
1 Timing Advanced	10%	12%	15%	15%	50%	50%	80%	80%	80%	80%	80%	80%	80%	80%	20%	30%	20%	30%
2 Timing Retarded	6%	13%	4%	4%	-20%	-20%	-20%	-20%	-20%	-20%	-10%	-10%	-10%	-10%	-0.5%	-0.5%	-0.5%	-0.5%
3 Minor Inj. Problem	20%	18%	16%	16%	0%	0%	0%	0%	0%	0%	10%	10%	10%	10%	20%	20%	10%	20%
4 Mod. Inj. Problems	16%	13%	10%	10%	-0%	-0%	-5%	-5%	-5%	-5%	-0.7%	-0.7%	-0.7%	-0.7%	160%	160%	160%	160%
5 Severe Inj. Problem	6%	6%	5%	5%	-10%	-10%	-10%	-10%	-10%	-10%	-0.5%	-0.5%	-0.5%	-0.5%	500%	500%	500%	500%
6 Puff Lt'sr Misat	16%	13%	2%	0%	0%	0%	0%	0%	0%	0%	0.05	0.05	0.05	0.05	0%	0%	0%	0%
7 Puff Lt'sr Disabled	16%	12%	4%	0%	0%	0%	0%	0%	0%	0%	0.05	0.05	0.05	0.05	-20%	-20%	0%	-2.4%
8 Maximum Fuel High	14%	10%	2%	2%	10%	10%	10%	10%	10%	10%	1.0%	1.0%	1.0%	1.0%	0%	0%	0%	0%
9 Clogged Air Filter	2%	1%	10%	10%	0%	0%	0%	0%	0%	0%	0.05	0.05	0.05	0.05	0%	0%	0%	0%
10 Wrong/Norn Turbo	10%	8%	3%	3%	0%	0%	0%	0%	0%	0%	0.05	0.05	0.05	0.05	0%	0%	0%	0%
11 Intercooler Clogged	1%	4%	3%	3%	10%	20%	25%	25%	25%	25%	0.8%	0.8%	0.8%	0.8%	-20%	-20%	-20%	-20%
12 Other Air Problems	1.6%	1.2%	0%	0%	0%	0%	0%	0%	0%	0%	0.05	0.05	0.05	0.05	0%	0%	0%	0%
13 Engine Mech. Failur	2%	2%	2%	2%	-10%	-10%	-10%	-10%	-10%	-10%	-0.2%	-0.2%	-0.2%	-0.2%	200%	200%	200%	200%
14 Excess Oil Can.	8%	6%	6%	6%	0%	0%	0%	0%	0%	0%	0.05	0.05	0.05	0.05	300%	300%	300%	300%
15 Electronics Failed	0%	2%	3%	3%	0%	0%	0%	0%	0%	0%	0.05	0.05	0.05	0.05	30%	30%	30%	30%
16 Electronics Tempere	0%	3%	10%	10%	0%	30%	80%	80%	80%	80%	0.05	0.05	0.05	0.05	300%	300%	300%	300%
17 Catalyst Removed	0%	0%	6%	6%	0%	0%	0%	0%	0%	0%	0.05	0.05	0.05	0.05	100%	100%	100%	100%
18 Trap Removed	0%	0%	6%	6%	0%	0%	0%	0%	0%	0%	0.05	0.05	0.05	0.05	40%	40%	40%	40%
19 EGR Disabled	0%	0%	3%	3%	0%	35%	35%	35%	35%	35%	1.1%	2.1%	0.7%	0.7%	15%	15%	15%	15%
% Increase Due to All Defects Combined																		
															3.8%	8.4%	11.0%	12.1%
															76.2%	73.4%	144.3%	176.3%

[Continued]

TABLE A-1. [Continued]

Medium-Heavy Duty Trucks		California Registered Federal Engines	Frequency of Defect Occurrence Among Trucks in this Class	Particulate Matter												Fuel Consumption			
Type of Defect	1980-1987	1988-1989	1990-1991	1992-1993	1993-1994	1994-Onward	1995-1996	1997-1998	1998-1999	1999-2000	1999-2001	1999-2002	1999-2003	1999-2004	% Change in Fleet-Average Emission Factor	% Change in Individual Vehicle Emission Factor	% Change in Fleet-Average Emission Factor	% Change in Individual Vehicle Emission Factor	% Change in Fleet-Average Emission Factor
1 Towing Advanced	10%	12%	15%	10%	0%	0%	1.0%	1.2%	0.0%	0.0%	0%	-2%	-5%	-2%	-0.0%	-0.2%	-0.3%	-0.3%	
2 Towing Retarded	6%	5%	4%	4%	30%	40%	100%	100%	2.0%	4.0%	7%	7%	10%	10%	0.4%	0.4%	0.4%	0.4%	0.4%
3 Minor Inj. Problems	20%	18%	15%	15%	36%	36%	70%	70%	6.3%	10.5%	2%	2%	2%	2%	0.4%	0.4%	0.3%	0.3%	0.3%
4 Mod. Inj. Problems	15%	10%	10%	10%	20%	40%	40%	40%	28.0%	40.0%	5%	6%	6%	6%	0.8%	0.7%	0.6%	0.6%	0.6%
5 Severe Inj. Problems	5%	5%	5%	5%	60%	60%	160%	160%	25.0%	76.0%	10%	10%	10%	10%	0.5%	0.5%	0.5%	0.5%	0.5%
6 Puff Lt's or Missat	10%	13%	25%	0%	20%	50%	50%	50%	3.6%	2.6%	1.0%	0.0%	1%	1%	1%	0.2%	0.1%	0.0%	0.0%
7 Puff Lt's or Disabled	10%	12%	45%	0%	50%	50%	100%	100%	7.0%	8.0%	4.0%	0.0%	2%	2%	2%	0.3%	0.2%	0.1%	0.0%
8 Maximum Fuel High	14%	10%	2%	2%	30%	30%	30%	30%	4.2%	3.0%	0.6%	0.8%	2%	2%	2%	0.3%	0.2%	0.0%	0.0%
9 Clogged Air Filter	20%	18%	10%	10%	50%	50%	50%	50%	11.5%	9.6%	5.0%	6.0%	2%	2%	2%	0.5%	0.4%	0.2%	0.2%
10 Wrong/Worn Turbo	10%	9%	3%	3%	40%	40%	60%	60%	4.0%	3.8%	2.5%	2.5%	1%	1%	1%	0.1%	0.1%	0.1%	0.1%
11 Intercooler Clogged	1%	4%	35%	35%	40%	40%	60%	60%	0.4%	1.8%	1.5%	1.5%	2%	2%	2%	0.0%	0.1%	0.1%	0.1%
12 Other Air Problems	14%	12%	6%	6%	40%	40%	40%	40%	5.8%	4.8%	3.2%	3.2%	1%	1%	1%	0.1%	0.1%	0.1%	0.1%
13 Engine Mech. Failur	2%	2%	2%	2%	160%	160%	300%	300%	3.0%	3.0%	0.0%	10.0%	7%	7%	6%	0.1%	0.1%	0.1%	0.1%
14 Excess Oil Cans.	6%	6%	6%	6%	160%	160%	300%	300%	12.0%	12.0%	24.0%	48.0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%
15 Electronics Failed	0%	2%	6%	6%	30%	30%	80%	80%	0.0%	0.0%	4.8%	4.8%	0%	4%	4%	0.0%	0.1%	0.3%	0.3%
16 Electronics Tempore	0%	3%	10%	10%	0%	50%	50%	50%	0.0%	0.0%	6.0%	6.0%	0%	0%	-6%	0.0%	0.0%	-0.6%	-0.6%
17 Catalyst Removed	0%	0%	6%	0%	0%	40%	0%	0%	0.0%	0.0%	3.2%	0.0%	0%	0%	-1%	0%	0.0%	-0.1%	0.0%
18 Trap Removed	0%	0%	9%	9%	30%	0%	200%	200%	0.0%	0.0%	18.0%	30.0%	0%	0%	-4%	0.0%	0.0%	-0.4%	-1.2%
19 EGR Disabled	0%	0%	3%	6%	0%	0%	0%	0%	-0.0%	0.0%	-0.0%	-0.0%	0%	0%	1%	0.0%	0.0%	0.1%	0.1%
* Increase Due to All Defects Combined																			
140.4%																			
261.6%																			
536.1%																			
3.7%																			
9.1%																			
0.7%																			

[Continued]

TABLE A-1. (Continued)

Type of Defect	Medium-Heavy Duty Trucks Out-of-State Registered										Unburned Hydrocarbons														
	Frequency of Defect Occurrence Among Trucks in this Class					% Change in Individual Vehicle Emission Factor					Oxides of Nitrogen					% Change in Fleet-Average Emission Factor					% Change in Individual Vehicle Emission Factor				
	1980-1987	1988-1989	1990-1991	1992-1993	Oneward	1980-1987	1988-1989	1990-1991	1992-1993	Oneward	1980-1987	1988-1989	1990-1991	1992-1993	Oneward	1980-1987	1988-1989	1990-1991	1992-1993	Oneward	1980-1987	1988-1989	1990-1991	1992-1993	Oneward
1 Timing Advanced	10%	12%	13%	13%	Oneward	-20%	-20%	-20%	-20%	Oneward	3.0%	3.0%	3.0%	3.0%	Oneward	20%	20%	20%	20%	Oneward	2.0%	2.0%	2.0%	2.0%	Oneward
2 Timing Retarded	6%	6%	4%	4%	Oneward	-20%	-20%	-20%	-20%	Oneward	-0.8%	-0.8%	-0.8%	-0.8%	Oneward	-10%	-10%	-10%	-10%	Oneward	-0.8%	-0.8%	-0.8%	-0.8%	Oneward
3 Minor Inj. Problems	20%	18%	15%	15%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward	10%	10%	10%	10%	Oneward	2.0%	1.8%	1.8%	1.8%	Oneward
4 Mod. Inj. Problems	16%	10%	10%	10%	Oneward	-5%	-5%	-5%	-5%	Oneward	-0.5%	-0.5%	-0.5%	-0.5%	Oneward	150%	150%	150%	150%	Oneward	22.5%	19.5%	19.5%	19.5%	Oneward
5 Severe Inj. Problem	5%	5%	5%	5%	Oneward	-10%	-10%	-10%	-10%	Oneward	-0.5%	-0.5%	-0.5%	-0.5%	Oneward	500%	500%	500%	500%	Oneward	25.0%	26.0%	26.0%	26.0%	Oneward
6 Puff Litter Misset	18%	13%	2%	0%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward
7 Puff Litter Disabled	10%	4%	0%	0%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward	-20%	-20%	-20%	-20%	Oneward	-3.0%	-2.0%	-2.0%	-2.0%	Oneward
8 Maximum Fuel High	4%	10%	2%	2%	Oneward	10%	10%	10%	10%	Oneward	1.4%	1.4%	1.4%	1.4%	Oneward	0.2%	0.2%	0.2%	0.2%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward
9 Clogged Air Filter	2%	10%	10%	10%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward
10 Wrong/Mern Turbo	10%	5%	5%	5%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward
11 Intercooler Clogged	1%	4%	3%	3%	Oneward	25%	25%	25%	25%	Oneward	0.1%	0.1%	0.1%	0.1%	Oneward	-20%	-20%	-20%	-20%	Oneward	-0.2%	-0.2%	-0.2%	-0.2%	Oneward
12 Other Air Problem	14%	12%	6%	6%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward
13 Engine Mech. Failure	1%	1%	1%	1%	Oneward	-10%	-10%	-10%	-10%	Oneward	-0.1%	-0.1%	-0.1%	-0.1%	Oneward	20%	20%	20%	20%	Oneward	2.0%	2.0%	2.0%	2.0%	Oneward
14 Excess Oil Cans.	6%	6%	6%	6%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward	300%	300%	300%	300%	Oneward	24.0%	24.0%	24.0%	24.0%	Oneward
15 Electronics Failed	0%	2%	0%	0%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward	30%	30%	30%	30%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward
16 Electronics Tempore	0%	3%	10%	10%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward
17 Catalyst Removed	0%	0%	6%	0%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward
18 Trap Removed	0%	0%	8%	8%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward	0%	0%	0%	0%	Oneward	0.0%	0.0%	0.0%	0.0%	Oneward
19 EGR Disabled	0%	0%	3%	3%	Oneward	0%	0%	0%	0%	Oneward	1.1%	2.1%	3.1%	4.1%	Oneward	0%	0%	0%	0%	Oneward	0.5%	0.5%	0.5%	0.5%	Oneward
% Increase Due to All Defects Combined																									
4.0%																									
79.2%																									

(Continued)

TABLE A-1. [Continued]

Type of Defect	Medium-Heavy Duty Trucks										Fuel Consumption																
	Out-of-State Registered Federal Engines					Frequency of Defect Occurrence Among Trucks in this Class					% Change in Individual Vehicle Emission Factor					% Change in Fleet-Average Emission Factor					% Change in Individual Vehicle Emission Factor						
	1980-1986-1991-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993	1980-1987-1993		
1 Tiring Advanced	10%	12%	15%	10%	5%	0%	1.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-2%	-3%	-3%	0.0%	-0.2%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	
2 Tiring Retarded	6%	6%	4%	3%	4%	100%	1.0%	2.0%	4.0%	4.0%	7%	7%	10%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3 Minor Inj. Problems	2%	3%	1%	1%	3%	35%	70%	70%	7.0%	6.3%	10.6%	10.6%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
4 Mod. Inj. Problems	1%	1%	1%	1%	2%	20%	40%	40%	30.0%	28.0%	40.0%	40.0%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
5 Severe Inj. Problem	0%	0%	0%	0%	0%	60%	60%	60%	42.0%	25.0%	76.0%	210.0%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	
6 Puff Litter Misset	1%	1%	2%	0%	2%	20%	50%	50%	3.0%	2.6%	1.0%	0.0%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
7 Puff Litter Disabled	1%	1%	4%	0%	5%	50%	50%	50%	100%	7.0%	8.0%	4.0%	0.0%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
8 Maximum Fuel High	1%	1%	2%	2%	3%	30%	30%	30%	4.2%	3.0%	0.6%	0.8%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
9 Clogged Air Filter	2%	1%	1%	1%	1%	60%	60%	60%	50%	11.6%	9.6%	6.0%	6.0%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
10 Wrong/Burn Turbo	1%	1%	6%	6%	4%	40%	60%	60%	4.0%	3.6%	2.6%	2.6%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
11 Intercooler Clogged	1%	4%	3%	3%	4%	40%	50%	50%	0.4%	1.6%	1.6%	1.6%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
12 Other Air Problems	1%	1%	6%	6%	4%	40%	40%	40%	40%	6.8%	4.6%	3.2%	3.2%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
13 Engine Mech. Failure	1%	1%	1%	1%	1%	150%	150%	150%	500%	1.6%	1.6%	3.0%	5.0%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
14 Excess Oil Losses	0%	0%	0%	0%	0%	150%	150%	150%	300%	60%	12.0%	24.0%	48.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
15 Electronics Failed	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4.6%	4.6%	0%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
16 Electronics Temper	0%	0%	0%	0%	0%	10%	10%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
17 Catalyst Removed	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
18 Trap Removed	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
19 EGR Disabled	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
% Increase Due To All Defects Combined																											
138.8%																											
3.7%																											

(Continued)

TABLE A-1. (Continued)

Light-Heavy Duty Trucks										Oxides of Nitrogen										Unburned Hydrocarbons									
California Registered Engines					Frequency of Defect Occurrence Among Trucks in this Class					% Change in Individual Vehicle Emission Factor					% Change in Fleet-Average Emission Factor					% Change in Individual Vehicle Emission Factor					% Change in Fleet-Average Emission Factor				
Type of Defect	1980-1987	1988-1990	1991-1993	1994-Onward	1980-1987	1988-1990	1991-1993	Onward	1980-1987	1988-1990	1991-1993	Onward	1980-1987	1988-1990	1991-1993	Onward	1980-1987	1988-1990	1991-1993	Onward	1980-1987	1988-1990	1991-1993	Onward					
1 Ticking Advanced	10%	8%	5%	3%	20%	20%	20%	20%	-20%	-20%	-10%	-10%	0%	0%	0%	0%	30%	30%	-10%	0%	0%	1.5%	1.5%						
2 Ticking Retarded	10%	6%	4%	4%	-20%	-20%	-20%	-20%	-20%	-20%	-0.5%	-0.5%	0%	0%	0%	0%	60%	60%	0.5%	0.5%	2.0%	2.0%							
3 Minor Inj. Problems	20%	18%	15%	15%	0%	0%	0%	0%	0%	0%	-0.5%	-0.5%	0.5%	0.5%	0.5%	0.5%	20%	20%	20%	20%	2.0%	2.0%							
4 Mod. Inj. Problems	10%	10%	10%	10%	-5%	-5%	-5%	-5%	-5%	-5%	-0.5%	-0.5%	0.5%	0.5%	0.5%	0.5%	150%	150%	300%	300%	30.0%	30.0%							
5 Severe Inj. Problem	5%	5%	5%	5%	-10%	-10%	-10%	-10%	-10%	-10%	-0.5%	-0.5%	0.5%	0.5%	0.5%	0.5%	600%	600%	1100%	1100%	55.0%	55.0%							
6 Puff Lt'ser Missat	2%	6%	2%	0%	0%	0%	0%	0%	0%	0%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0%	0%	0%	0.5%	0.5%	0.5%							
7 Puff Lt'ser Disabled	1%	3%	4%	0%	0%	0%	0%	0%	0%	0%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	-20%	-20%	-20%	-20%	-0.5%	-0.5%							
8 Maximum Fuel High	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	1.5%	1.5%	0.5%	0.5%	0.5%	0.5%	0%	0%	0%	0.5%	0.5%	0.5%							
9 Clogged Air Filter	2%	10%	10%	10%	0%	0%	0%	0%	0%	0%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0%	0%	0%	0.5%	0.5%	0.5%							
10 Wrong/Storm Turbo	5%	10%	7%	0%	0%	0%	0%	0%	0%	0%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0%	0%	0%	0.5%	0.5%	0.5%							
11 Intercooler Clogged	0%	4%	3%	3%	20%	20%	20%	20%	20%	20%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	-20%	-20%	-20%	-20%	-0.5%	-0.5%							
12 Other Air Proble	0%	12%	6%	6%	0%	0%	0%	0%	0%	0%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0%	0%	0%	0.5%	0.5%	0.5%							
13 Engine Mech. Failur	2%	2%	2%	2%	-10%	-10%	-10%	-10%	-10%	-10%	-0.25%	-0.25%	-0.25%	-0.25%	-0.25%	-0.25%	200%	200%	500%	500%	4.0%	4.0%							
14 Excess Oil Cans.	10%	10%	10%	10%	0%	0%	0%	0%	0%	0%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	300%	300%	300%	300%	30.0%	30.0%							
15 Electronics Failed	0%	2%	6%	6%	0%	0%	0%	0%	0%	0%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	50%	50%	50%	50%	0.5%	0.5%							
16 Electronics Failed	0%	1%	7%	7%	0%	0%	0%	0%	0%	0%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0%	0%	0%	0.5%	0.5%	0.5%							
17 Electronic Tempore	0%	0%	6%	6%	0%	0%	0%	0%	0%	0%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0%	0%	0%	0.5%	0.5%	0.5%							
18 Catalyst Removed	0%	0%	10%	10%	0%	0%	0%	0%	0%	0%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	40%	40%	100%	100%	0.5%	0.5%							
19 EGR Disabled	0%	0%	8%	8%	0%	0%	0%	0%	0%	0%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	20%	20%	20%	20%	1.25	1.25							
% Increase Due to All Defects Combined										0.0% 1.7% 10.5% 12.4%										62.0% 78.3% 154.8% 182.8%									

[Continued]

TABLE A-1. [Continued]

Type of Defect	Light-Heavy Duty Trucks		California Registered California Engines		Frequency of Defect Occurrence Among Trucks in this Class		Particulate Matter		Fuel Consumption	
	1980-1987	1988-1989	1981-1982	1984-1985	1980-1987	1988-1989	1981-1982	1984-1985	1980-1987	1988-1989
	Defect	Defect	Defect	Defect	Defect	Defect	Defect	Defect	Emission Factor	Emission Factor
1 Timing Advanced	10%	8%	5%	6%	10%	0%	0%	1.0%	0.8%	0.0%
2 Timing Retarded	10%	8%	4%	4%	20%	100%	20%	2.0%	1.2%	4.0%
3 Minor Inj. Problems	20%	16%	16%	16%	20%	70%	4.0%	3.8%	10.6%	1.0%
4 Hard. Inj. Problems	16%	13%	10%	10%	100%	400%	16.0%	13.0%	40.0%	3.0%
5 Severe Inj. Problem	8%	6%	6%	6%	500%	1600%	4200%	26.0%	210.0%	5%
6 Puff Litter Missed	2%	5%	2%	0%	20%	50%	50%	0.4%	1.0%	1.0%
7 Puff Litter Disabled	1%	3%	4%	0%	50%	100%	100%	0.6%	1.6%	0.0%
8 Maxima Fuel High	15%	13%	13%	13%	50%	30%	30%	7.5%	8.5%	1.5%
9 Clogged Air Filter	21%	18%	10%	10%	80%	60%	60%	12.6%	11.4%	6.0%
10 Wrong/Burn Turbo	5%	10%	7%	7%	40%	50%	50%	4.0%	3.5%	4.0%
11 Intercooler Clogged	0%	4%	3%	3%	40%	60%	60%	0.0%	1.6%	0.0%
12 Other Air Problems	8%	12%	8%	8%	40%	40%	40%	3.6%	3.2%	3.0%
13 Engine Mech. Failure	2%	2%	2%	2%	160%	160%	500%	3.0%	6.0%	10.0%
14 Excess Oil Losses	10%	10%	10%	10%	120%	150%	300%	12.0%	16.0%	30.0%
15 Electronics Failed	0%	2%	8%	8%	90%	90%	60%	0.0%	0.9%	4.8%
16 Electronics Tampera	0%	1%	7%	7%	0%	50%	50%	0.0%	3.6%	3.6%
17 Catalyst Removed	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%
18 Trap Removed	0%	0%	16%	20%	0%	0%	200%	0.0%	30.0%	90.0%
19 EGR Disabled	0%	0%	6%	6%	0%	0%	-10%	-10%	0.0%	-0.0%
% Increase Due to All Defects Combined										1.7%
86.2%										282.7%
104.1%										548.1%

[Continued]

TABLE A-1. [Continued]

Type of Defect	California Registered Federal Engines	Frequency of Defect Occurrence Among Trucks in this Class		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		Unburned Hydrocarbons											
		1980-1982	1981-1984	1980-1983	1981-1983	1980-1983	1981-1984	1980-1983	1981-1984										
		1987	1990	1983	Oneward	1987	1990	1983	Oneward	1987	1990	1983	Oneward	1987	1990	1983	Oneward	1987	1990
1 Timing Advanced	6%	1	6%	5%	20%	30%	60%	2.0%	2.4%	3.0%	-1.0%	20%	30%	30%	30%	-1.0%	1.6%	1.6%	1.5%
2 Timing Retarded	10%	6%	4%	4%	-20%	-20%	-20%	-2.0%	-1.2%	-0.8%	-0.3%	0%	0%	6%	6%	0.0%	0.0%	2.0%	2.0%
3 Minor Inj. Problems	20%	16%	16%	15%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	10%	10%	20%	20%	2.0%	1.6%	3.0%	3.0%
4 Mod. Inj. Problems	13%	10%	10%	6%	-6%	-6%	-6%	-0.6%	-0.7%	-0.5%	-0.5%	150%	150%	300%	300%	22.5%	19.5%	30.0%	30.0%
5 Severe Inj. Problems	5%	5%	5%	5%	-10%	-10%	-10%	-0.5%	-0.5%	-0.5%	-0.5%	500%	500%	1100%	1100%	26.0%	26.0%	55.0%	55.0%
6 Puff Lat'l Misast	2%	5%	2%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%
7 Puff Lat'l Disabled	1%	3%	4%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	-20%	-20%	0%	0%	-0.2%	-0.2%	0.0%	0.0%
8 Maximum Fuel High	16%	13%	6%	6%	10%	10%	10%	1.5%	1.3%	0.6%	0.6%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%
9 Clogged Air Filter	21%	16%	10%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%
10 Wrong/Worn Turbo	6%	10%	7%	7%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%
11 Intercooler Clogged	0%	4%	3%	3%	10%	20%	20%	0.0%	0.0%	0.0%	0.0%	-20%	-20%	-20%	-20%	0.0%	0.0%	-0.8%	-0.8%
12 Other Air Problems	8%	12%	8%	8%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%
13 Engine Mech. Failure	2%	2%	2%	2%	-10%	-10%	-10%	-0.2%	-0.2%	-0.2%	-0.2%	200%	200%	500%	500%	4.0%	4.0%	6.0%	10.0%
14 Excess Oil Cons.	10%	10%	10%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	300%	300%	300%	300%	30.0%	30.0%	30.0%	30.0%
15 Electronics Failed	0%	2%	8%	8%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	30%	30%	50%	50%	0.0%	0.0%	4.0%	4.0%
16 Electronics Temperature	0%	1%	7%	7%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%
17 Catalyst Removed	0%	0%	8%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%
18 Trap Removed	0%	0%	10%	30%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	40%	40%	0.0%	0.0%	6.0%	30.0%
19 EGR Disabled	0%	0%	8%	8%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	20%	20%	0.0%	0.0%	1.2%	1.8%
% Increase Due to All Defects Combined																			
0.0%																			
2.3%																			
12.4%																			
82.0%																			
81.2%																			
154.8%																			
182.8%																			

[Continued]

TABLE A-1. [Continued]

Type of Defect	California Registered Federal Engines		Frequency of Defect Occurrence Among Trucks in this Class		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		Particulate Matter		Fuel Consumption	
	1980-1987	1988-1990	1991-1993	1994-Forward	1990-1997	1998-1999	1991-1993	1994-Forward	1990-1997	1998-1999	1991-1993	1994-Forward
1 Timing Advanced	10%	8%	5%	10%	10%	0%	1.0%	0.8%	0.0%	0.0%	-0%	-0.2%
2 Timing Retarded	10%	8%	4%	20%	20%	100%	2.0%	1.2%	4.0%	4.0%	6%	0.5%
3 Minor Inj. Problems	20%	16%	15%	20%	70%	400%	3.0%	10.0%	10.0%	10.0%	1%	2%
4 Mod. Inj. Problems	10%	10%	10%	100%	400%	400%	15.0%	19.0%	40.0%	40.0%	3%	3%
5 Severe Inj. Problems	5%	5%	5%	500%	500%	1500%	25.0%	25.0%	75.0%	75.0%	6%	6%
6 Puff Lt./er Missat	2%	3%	2%	20%	60%	50%	0.4%	1.0%	0.0%	0.0%	1%	1%
7 Puff Lt./er Disabled	1%	3%	4%	0%	50%	50%	1.0%	1.0%	4.0%	4.0%	2%	2%
8 Maximum Fuel High	15%	13%	5%	50%	50%	30%	7.0%	8.0%	1.5%	1.5%	2%	2%
9 Clogged Air Filter	21%	18%	10%	10%	60%	60%	12.0%	11.4%	5.0%	5.0%	2%	2%
10 Wrong/Burn Turbo	5%	10%	7%	7%	40%	50%	2.0%	4.0%	3.0%	3.0%	1%	1%
11 Intercooler Clogged	0%	4%	3%	40%	40%	50%	0.0%	1.6%	1.5%	1.5%	2%	2%
12 Other Air Problems	9%	12%	8%	40%	40%	40%	3.8%	4.8%	3.2%	3.2%	1%	1%
13 Engine Mech. Failure	2%	2%	2%	150%	300%	500%	3.0%	3.0%	10.0%	7%	7%	6%
14 Excess Oil Cons.	10%	10%	10%	150%	300%	600%	15.0%	15.0%	80.0%	80.0%	0%	0%
15 Electronics Failed	0%	2%	2%	0%	30%	60%	0.0%	0.8%	4.0%	4.0%	4%	4%
16 Electronics Tempers	0%	1%	7%	7%	0%	50%	0.0%	0.0%	3.0%	3.0%	0%	0%
17 Catalyst Removed	0%	0%	0%	0%	0%	40%	0.0%	0.0%	3.2%	0.0%	-1%	0%
18 Trap Removed	0%	0%	15%	30%	0%	200%	0.0%	0.0%	30.0%	30.0%	0%	-4%
19 EGR Disabled	0%	0%	6%	6%	0%	0%	-10%	0.0%	-0.8%	-0.8%	0%	0%
% Increase Due to All Defects Combined												
	101.2%	104.1%	292.7%	540.1%							2.5%	2.2%
												0.8%

[Continued]

TABLE A-1. (Continued)

Type of Defect	Light-duty Trucks		Out-of-State Registered Federal Engines		Frequency of Defect Occurrence Among Trucks in this Class		X Change in Individual Vehicle Emission Factor		X Change in Fleet-Average Emission Factor		X Change in Individual Vehicle Emission Factor		X Change in Fleet-Average Emission Factor		Unburned Hydrocarbons					
	1980-1987		1981-1983		1984-1987		1981-1983		1980-1987		1981-1983		1980-1987		1981-1983					
	1987	1990	1987	1990	1987	1990	1987	1990	1987	1990	1987	1990	1987	1990	1987	1990	1987	1990		
1 Timing Advanced	10%	8%	10%	8%	20%	30%	8%	8%	2.4%	3.0%	3.0%	3.0%	20%	30%	-1.0%	-1.0%	1.0%	1.0%		
2 Timing Retarded	10%	6%	4%	4%	-20%	-20%	-20%	-20%	-2.0%	-1.8%	-0.8%	-0.8%	0%	0%	0.0%	0.0%	2.0%	2.0%		
3 Minor Inj. Problems	20%	18%	18%	18%	0%	0%	0%	0%	0.0%	0.0%	10%	10%	20%	20%	2.0%	1.8%	3.0%	3.0%		
4 Mod. Inj. Problems	10%	10%	10%	10%	-5%	-5%	-5%	-5%	-0.8%	-0.7%	-0.5%	-0.5%	0%	0%	0.0%	0.0%	30.0%	30.0%		
5 Severe Inj. Problem	5%	5%	5%	5%	-10%	-10%	-10%	-10%	-1.0%	-0.8%	-0.5%	-0.5%	0%	0%	0.0%	0.0%	55.0%	55.0%		
6 Puff Lt's or Miss	2%	5%	2%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0.0%	0.0%	0.0%	0.0%		
7 Puff Lt's or Disabled	1%	3%	4%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	-20%	0%	-0.2%	-0.2%	0.0%	0.0%		
8 Maximum Fuel High	10%	10%	5%	5%	10%	10%	10%	10%	1.0%	1.0%	0.5%	0.5%	0%	0%	0.0%	0.0%	0.0%	0.0%		
9 Clogged Air Filter	2%	10%	10%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0.0%	0.0%	0.0%	0.0%		
10 Wrong/Norm Turbo	5%	10%	7%	7%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0.0%	0.0%	0.0%	0.0%		
11 Intercooler Clogged	0%	4%	3%	3%	10%	20%	20%	20%	0.0%	0.0%	0.0%	0.0%	-20%	-20%	-0.0%	-0.0%	-0.0%	-0.0%		
12 Other Air Problems	5%	10%	8%	8%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0.0%	0.0%	0.0%	0.0%		
13 Engine Mech. Failure	1%	1%	1%	1%	-10%	-10%	-10%	-10%	-0.1%	-0.1%	-0.1%	-0.1%	20%	20%	0.0%	0.0%	3.0%	5.0%		
14 Excess Oil Consumption	10%	10%	10%	10%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	30%	30%	0.0%	0.0%	30.0%	30.0%		
15 Electronics Failed	0%	2%	8%	8%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	30%	30%	0.0%	0.0%	4.0%	4.0%		
16 Electronics Tempers	0%	1%	7%	7%	0%	0%	0%	0%	0.0%	0.0%	5.0%	5.0%	0%	0%	0.0%	0.0%	0.0%	0.0%		
17 Catalyst Removed	0%	0%	8%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0.0%	0.0%	0.0%	0.0%		
18 Trap Removed	0%	0%	10%	30%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	40%	100%	0.0%	0.0%	6.0%	30.0%		
19 EGR Disabled	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	3.0%	4.0%	0%	20%	0.0%	0.0%	1.0%	1.0%		
% Increase Due to All Defects Combined																				
									0.1%	2.4%	11.0%	10.5%					80.0%	79.2%	161.8%	177.8%

A-17

{Continued}

TABLE A-1. (Continued)

Type of Defect	Light-Hd Duty Trucks		Out-of-State Registered Federal Engines		Frequency of Defect Occurrence Among Trucks in this Class		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		Fuel Consumption					
	1980-1987		1981-1983		1984-1987		1988-1993		1994-1997		1998-1999		1991-1993		1994-1997		1998-1999			
	1987	1990	1983	Onward	1987	1990	1993	Onward	1987	1990	1993	Onward	1987	1990	1993	Onward	1987	1990		
1 Timing Advanced	10%	6%	6%	6%	10%	10%	6%	6%	0.0%	0.0%	0.0%	0.0%	-2%	-2%	-2%	-2%	-0.2%	-0.2%		
2 Timing Retarded	10%	6%	4%	4%	20%	20%	100%	2.0%	1.2%	4.0%	4.0%	6%	6%	10%	10%	0.6%	0.3%	0.4%	0.4%	
3 Minor Inj. Problems	20%	18%	16%	16%	20%	20%	70%	70%	4.0%	3.8%	10.6%	10.6%	1%	1%	2%	2%	0.2%	0.3%	0.3%	0.3%
4 Med. Inj. Problems	13%	13%	10%	10%	100%	100%	40%	40%	15.0%	13.0%	40.0%	40.0%	3%	3%	5%	5%	0.6%	0.4%	0.6%	0.6%
5 Severe Inj. Problem	5%	5%	6%	6%	50%	50%	160%	420%	25.0%	26.0%	76.0%	210.0%	5%	5%	10%	10%	0.3%	0.3%	0.6%	0.6%
6 Puff Litter Misset	2%	5%	2%	0%	20%	20%	60%	60%	0.4%	1.0%	0.0%	1.0%	1%	1%	1%	1%	0.0%	0.1%	0.0%	0.0%
7 Puff Litter Blasbld	1%	3%	4%	0%	50%	50%	100%	100%	0.1%	1.5%	4.0%	0.0%	2%	2%	2%	2%	0.0%	0.1%	0.0%	0.0%
8 Maximum Fuel High	13%	13%	6%	6%	50%	50%	30%	30%	7.0%	6.8%	1.6%	1.6%	2%	2%	2%	2%	0.3%	0.3%	0.1%	0.1%
9 Clogged Air Filter	21%	10%	10%	10%	80%	80%	60%	60%	12.6%	11.4%	6.0%	5.0%	2%	2%	2%	2%	0.4%	0.4%	0.2%	0.2%
10 Wrong/Burn Turbo	6%	10%	7%	7%	40%	40%	50%	50%	2.0%	4.0%	3.6%	3.6%	1%	1%	1%	1%	0.1%	0.1%	0.1%	0.1%
11 Intercooler Clogged	0%	4%	3%	3%	40%	40%	60%	60%	0.0%	1.6%	1.6%	1.6%	2%	2%	2%	2%	0.0%	0.1%	0.1%	0.1%
12 Other Air Problems	9%	12%	8%	8%	40%	40%	40%	40%	3.6%	4.6%	3.2%	3.2%	1%	1%	1%	1%	0.1%	0.1%	0.1%	0.1%
13 Engine Mach. Failure	1%	1%	1%	1%	15%	15%	300%	500%	1.6%	1.6%	3.0%	5.0%	7%	7%	8%	8%	0.1%	0.1%	0.1%	0.1%
14 Excess Oil Cons.	10%	10%	10%	10%	150%	150%	300%	600%	15.0%	16.0%	30.0%	60.0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%
15 Electronics Failed	0%	2%	8%	6%	0%	30%	60%	60%	0.0%	0.0%	4.8%	4.8%	0%	0%	4%	4%	0.0%	0.1%	0.3%	0.3%
16 Electronics Tempore	0%	1%	7%	7%	0%	0%	60%	60%	0.0%	0.0%	9.6%	3.6%	0%	0%	-5%	-5%	0.0%	0.0%	-0.4%	-0.4%
17 Catalyst Removed	0%	0%	8%	0%	0%	0%	40%	60%	0.0%	0.0%	3.2%	0.6%	0%	0%	-1%	-1%	0.0%	0.0%	-0.1%	0.0%
18 Trap Removed	0%	0%	15%	30%	0%	0%	200%	300%	0.0%	0.0%	30.0%	90.0%	0%	0%	-4%	-4%	0.0%	0.0%	-1.2%	-1.2%
19 EGR Dichted	0%	0%	8%	9%	0%	0%	-10%	-10%	0.0%	0.0%	-0.9%	-0.9%	0%	0%	1%	1%	0.0%	0.0%	0.1%	0.1%
% Increase Due to All Defects Combined																				
													89.7%	102.8%	279.7%	643.1%	2.4%	2.2%	1.6%	0.9%

(Continued)

TABLE A-1. (Continued)

Type of Defect	Urban Transit Buses										Oxides of Nitrogen										Unburned Hydrocarbons												
	California Registered					Frequency of Defect Occurrence Among Trucks in this Class					% Change in Individual Vehicle Emission Factor					% Change in Fleet-Average Emission Factor					% Change in Individual Vehicle Emission Factor					% Change in Fleet-Average Emission Factor							
	1980-1987	1988-1993	1991-1994	1990-1997	1989-1993	1981-1987	1980-1983	1980-1983	1981-1987	1980-1983	1981-1987	1980-1983	1981-1987	1980-1983	1981-1987	1980-1983	1981-1987	1980-1983	1981-1987	1980-1983	1981-1987	1980-1983	1981-1987	1980-1983	1981-1987	1980-1983	1981-1987	1980-1983	1981-1987				
1 Ticking Advanced	10%	3%	12%	2%	2%	70%	50%	80%	60%	10.5%	1.5%	1.2%	1.2%	0%	0%	30%	30%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
2 Ticking Retarded	10%	3%	12%	2%	2%	-20%	-20%	-20%	-20%	-3.0%	-1.0%	-0.4%	-0.4%	30%	20%	50%	50%	4.5%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	
3 Minor Inj. Problems	10%	10%	10%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	10%	10%	20%	20%	1.5%	1.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	
4 Mod. Inj. Problems	10%	7%	6%	-6%	-5%	-5%	-6%	-5%	-5%	-0.6%	-0.4%	-0.3%	-0.3%	150%	150%	300%	300%	15.0%	10.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%
5 Severe Inj. Problem	2%	1%	1%	1%	1%	-10%	-10%	-10%	-10%	-0.2%	-0.1%	-0.1%	-0.1%	500%	500%	1100%	1100%	10.0%	5.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%
6 Puff Lt/er Misset	8%	1%	1%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
7 Puff Lt/er Disabled	2%	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	-20%	-20%	-20%	-20%	0%	0%	-0.4%	-0.4%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
8 Maximum Fuel High	0%	1%	0%	0%	0%	10%	10%	10%	10%	0.5%	0.1%	0.0%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
9 Clogged Air Filter	10%	11%	6%	6%	6%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
10 Wrong/Torn Turbo	5%	4%	4%	-10%	-10%	0%	0%	0%	0%	-0.6%	-0.4%	-0.4%	-0.4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
11 Intake/Exh Clogged	1%	4%	3%	3%	2%	2%	2%	2%	2%	0.6%	0.6%	0.6%	0.6%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%				
12 Other Air Problems	10%	5%	4%	4%	4%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
13 Engine Mech. Failur	1%	1%	1%	1%	1%	-10%	-10%	-10%	-10%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%				
14 Excess Oil Cons.	0%	5%	6%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
15 Electronics Failed	0%	2%	2%	2%	2%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
16 Electronics Tempore	0%	2%	2%	2%	2%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
17 Catalyst Removed	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
18 Trap Reversed	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
19 EGR Disabled	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
% Increase Due to All Defects Combined																																	
6.9%																																	
49.0%																																	
34.4%																																	
59.6%																																	
69.5%																																	

[Continued]

TABLE A-1. (Continued)

Type of Defect	Urban Transit Buses		California Registered Federal Engines		Frequency of Defect Occurrence Among Trucks in this Class		% Change in Individual Vehicle Emission Factor		Particulate Matter		Fuel Consumption		% Change in Fleet-Average Emission Factor		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		
	1980-1987		1988-1993		1984-1997		1986-1993		1981-1994		1980-1987		1989-1994		1980-1987		1989-1994		
	Defect	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward
1 Timing Advanced	10%	2%	2%	2%	10%	0%	0%	1.0%	0.2%	0.0%	0%	-2%	-2%	-0.0%	0.0%	-0.1%	-0.1%	-0.1%	-0.1%
2 Timing Retarded	20%	6%	2%	2%	30%	40%	100%	6.0%	2.0%	2.0%	7%	7%	10%	1.4%	0.4%	0.2%	0.2%	0.2%	0.2%
3 Minor Inj. Problems	10%	10%	10%	10%	30%	35%	70%	5.3%	3.5%	7.0%	7.0%	2%	2%	2%	0.3%	0.2%	0.2%	0.2%	0.2%
4 Mod. Inj. Problems	10%	7%	6%	6%	20%	40%	400%	20.0%	14.0%	24.0%	6%	6%	6%	5%	0.3%	0.4%	0.3%	0.3%	0.3%
5 Severe Inj. Problem	2%	1%	1%	1%	60%	600%	4200%	10.0%	5.0%	42.0%	42.0%	10%	10%	10%	0.2%	0.1%	0.1%	0.1%	0.1%
6 Puff Ltter Misset	5%	1%	0%	0%	20%	20%	60%	50%	1.0%	0.2%	0.0%	0.0%	1%	1%	1%	0.1%	0.0%	0.0%	0.0%
7 Puff Ltter Disabled	2%	0%	0%	0%	60%	60%	100%	1.0%	0.0%	0.0%	2%	2%	2%	2%	0.0%	0.0%	0.0%	0.0%	0.0%
8 Maximum Fuel High	1%	0%	0%	0%	30%	30%	30%	1.5%	0.3%	0.0%	2%	2%	2%	2%	0.1%	0.0%	0.0%	0.0%	0.0%
9 Clogged Air Filter	10%	1%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%
10 Wrong/Norm Turbo	5%	4%	4%	4%	40%	40%	60%	2.0%	1.0%	2.0%	1.0%	1%	1%	1%	0.1%	0.0%	0.0%	0.0%	0.0%
11 Intercooler Clogged	1%	4%	3%	3%	40%	50%	50%	0.4%	1.6%	1.6%	1.6%	1%	1%	1%	0.1%	0.1%	0.1%	0.1%	0.1%
12 Other Air Probleme	10%	0%	4%	4%	40%	40%	40%	40%	4.0%	2.0%	1.6%	1.6%	1%	1%	1%	0.1%	0.0%	0.0%	0.0%
13 Engine Mach. Failure	1%	1%	1%	1%	150%	150%	300%	6.0%	1.6%	3.0%	5.0%	7%	7%	7%	0.1%	0.1%	0.1%	0.1%	0.1%
14 Excess Oil Cone.	5%	6%	6%	6%	150%	150%	900%	7.5%	7.5%	30.0%	30.0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%
15 Electronics Failed	0%	2%	2%	2%	0%	30%	60%	80%	0.0%	0.0%	1.2%	1.2%	0%	4%	0.0%	0.1%	0.1%	0.1%	0.1%
16 Electronics Tassers	0%	2%	2%	2%	0%	0%	60%	60%	0.0%	0.0%	1.0%	1.0%	0%	0%	-0.5%	0.0%	0.0%	-0.1%	-0.1%
17 Catalyst Removed	0%	0%	0%	0%	0%	0%	40%	0%	0.0%	0.0%	0.0%	0%	0%	-1%	0%	0.0%	0.0%	0.0%	0.0%
18 Trap Removed	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%
19 EGR Disabled	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%
% Increase Due to All Defects Combined																			
																			2.8%
																			1.3%
																			0.9%
																			0.9%

TABLE A-1. [Continued]

Type of Defect	Urban Transit Buses		California Registered Federal Engines		Frequency of Defect Occurrence Among Trucks in this Class		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		Unburned Hydrocarbons		
	1980-1987		1981-1983		1980-1987		1981-1983		1980-1987		1981-1983		1980-1987		1981-1983		
	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward	Onward
1 Timing Advanced	10%	2%	2%	2%	60%	60%	60%	60%	1.0%	1.0%	20%	20%	30%	30%	2.0%	0.4%	0.6%
2 Timing Retarded	20%	5%	2%	2%	-20%	-20%	-20%	-20%	-4.0%	-4.0%	-10%	-10%	60%	50%	-2.0%	-0.5%	1.0%
3 Minor Inj. Problems	10%	10%	10%	10%	0%	0%	0%	0%	0.0%	0.0%	10%	10%	20%	20%	1.0%	1.0%	2.0%
4 Mod. Inj. Problems	10%	7%	6%	6%	-3%	-3%	-3%	-3%	-0.4%	-0.4%	-0.3%	-0.3%	150%	300%	300%	10.5%	10.0%
5 Severe Inj. Problem	2%	1%	1%	1%	-10%	-10%	-10%	-10%	-0.2%	-0.2%	-0.1%	-0.1%	500%	1100%	1100%	10.0%	6.0%
6 Puff Lt'er Misset	5%	1%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0.5%	0.0%	0.0%
7 Puff Lt'er Disabled	2%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	-20%	-20%	0%	-0.4%	0.0%
8 Maximum Fuel High	5%	1%	0%	0%	10%	10%	10%	10%	0.1%	0.1%	0.0%	0.0%	0%	0%	0.0%	0.0%	0.0%
9 Clogged Air Filter	10%	1%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0.5%	0.0%	0.0%
10 Wrong/Mann Turbo	5%	4%	4%	4%	-10%	-10%	-10%	-10%	-0.5%	-0.5%	-0.4%	-0.4%	0%	0%	0.0%	0.0%	0.0%
11 Intercooler Clogged	1%	4%	3%	3%	10%	20%	25%	25%	0.1%	0.1%	0.0%	0.0%	-20%	-20%	-0.2%	-0.6%	-0.6%
12 Other Air Problems	10%	5%	4%	4%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0.0%	0.0%	0.0%
13 Engine Mech. Failure	1%	1%	1%	1%	-10%	-10%	-10%	-10%	-0.1%	-0.1%	-0.1%	-0.1%	200%	200%	200%	2.0%	3.0%
14 Excess OIL Cons.	5%	5%	5%	5%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	300%	300%	300%	15.0%	15.0%
15 Electronics Failed	0%	2%	2%	2%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	50%	50%	50%	0.8%	1.0%
16 Electronics Tempers	0%	2%	2%	2%	0%	30%	60%	60%	0.0%	0.0%	1.6%	1.6%	0%	0%	0.0%	0.0%	0.0%
17 Catalyst Removed	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0.0%	0.0%	0.0%
18 Trap Reoved	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0.0%	0.0%	0.0%
19 EGR Disabled	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0.0%	0.0%	0.0%
% Increase Due to All Defects Combined																	
0.3%																	
0.3%																	
42.8%																	
51.4%																	
53.4%																	

(Continued)

TABLE A-1. [Continued]

Type of Defect	Urban Transit Buses		California Registered California Engines		Frequency of Defect Occurrence Among Trucks in This Class		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		% Change in Individual Vehicle Emission Factor		% Change in Fleet-Average Emission Factor		Fuel Consumption			
	1980-1987		1981-1993		1980-1987		1981-1993		1980-1987		1981-1993		1980-1987		1981-1993			
	Defect	Onward	Defect	Onward	Defect	Onward	Defect	Onward	Defect	Onward	Defect	Onward	Defect	Onward	Defect	Onward	Defect	
1 Timing Advanced	15%	3%	2%	2%	-25%	-20%	0%	0%	-3.6%	-0.8%	0.0%	0.0%	-7%	-4%	-3%	-1.1%	-0.1%	-0.1%
2 Timing Retarded	15%	5%	1%	2%	2%	50%	25%	100%	7.5%	1.3%	2.0%	2.0%	10%	7%	10%	1.5%	0.4%	0.2%
3 Minor Inj. Problems	10%	10%	10%	10%	36%	35%	70%	70%	5.3%	3.5%	7.0%	7.0%	2%	2%	2%	0.3%	0.2%	0.2%
4 Mod. Inj. Problems	10%	7%	6%	6%	20%	20%	40%	40%	20.0%	14.0%	24.0%	24.0%	6%	6%	6%	0.5%	0.4%	0.3%
5 Severe Inj. Problem	2%	1%	1%	1%	50%	50%	420%	420%	10.0%	5.0%	42.0%	42.0%	10%	10%	10%	0.2%	0.1%	0.1%
6 Puff Ltter Misset	5%	1%	0%	0%	20%	20%	60%	60%	1.0%	0.2%	0.0%	0.0%	1%	1%	1%	0.1%	0.0%	0.0%
7 Puff Ltter Disabled	2%	0%	0%	0%	60%	60%	100%	100%	1.0%	0.0%	0.0%	0.0%	2%	2%	2%	0.0%	0.0%	0.0%
8 Maximum Fuel High	5%	1%	0%	0%	30%	30%	30%	30%	1.6%	0.3%	0.0%	0.0%	2%	2%	2%	0.1%	0.0%	0.0%
9 Clogged Air Filter	15%	11%	6%	6%	60%	60%	60%	60%	7.6%	5.5%	3.0%	3.0%	2%	2%	2%	0.3%	0.2%	0.1%
10 Wrong/Stand Turbo	5%	4%	4%	4%	40%	40%	50%	50%	2.0%	1.6%	2.0%	2.0%	1%	1%	1%	0.1%	0.0%	0.0%
11 Intercooler Clogged	1%	4%	3%	3%	40%	40%	60%	60%	0.4%	1.6%	1.6%	1.6%	2%	2%	2%	0.0%	0.1%	0.1%
12 Other Air Problems	10%	5%	4%	4%	40%	40%	40%	40%	4.0%	2.0%	1.6%	1.6%	1%	1%	1%	0.1%	0.0%	0.0%
13 Engine Mech. Failure	1%	1%	1%	1%	150%	150%	300%	300%	1.6%	1.6%	3.0%	3.0%	7%	7%	7%	0.1%	0.1%	0.1%
14 Excess Oil Cons.	5%	5%	5%	5%	120%	120%	600%	600%	6.0%	7.5%	30.0%	30.0%	0%	0%	0%	0.0%	0.0%	0.0%
15 Electronics Failed	0%	2%	2%	2%	0%	30%	60%	60%	0.0%	0.6%	1.2%	1.2%	0%	4%	4%	0.0%	0.1%	0.1%
16 Electronic Sensors	0%	2%	2%	2%	0%	0%	50%	50%	0.0%	0.0%	1.0%	1.0%	0%	-5%	-5%	0.0%	-0.1%	-0.1%
17 Catalyst Removed	0%	0%	0%	0%	0%	40%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	-1%	-1%	0.0%	0.0%	0.0%
18 Trap Removed	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	10.0%	15.0%	0%	-4%	-4%	0.0%	-0.2%	-0.2%
19 EGR Disabled	0%	0%	0%	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0.0%	0.0%	0.0%
% Increase Due to All Defects Combined																2.2%	1.4%	0.8%
71.6%																71.6%	48.3%	137.7%
147.1%																147.1%	147.1%	147.1%

(Continued)

TABLE A-2. EMISSION AND FUEL CONSUMPTION FACTORS FOR THE BASELINE CASE: G/BHP-KM

Heavy-Haavy Duty Trucks
California Registered
California Engines

{Continued}

TABLE A-2. (Continued)

Heavy-Hd Duty Trucks
California Registered
Federal Engines

Model Year	Oxides of Nitrogen [g/BHP-hr]			Unburned Hydrocarbons [g/BHP-hr]			Particulate Matter [g/BHP-hr]			Fuel Consumption [lb/BHP-hr]		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1980	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.86	1.66	4.6%
1981	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1982	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.66	4.6%
1983	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.96	1.66	4.6%
1984	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.96	1.66	4.6%
1985	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1986	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1987	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1988	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1989	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1990	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1991	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1992	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1993	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1994	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1995	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1996	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1997	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1998	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
1999	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%
2000	0.00	0.24	0.24	2.7%	0.80	0.41	1.21	51.3%	0.70	0.98	1.68	4.6%

[Continued]

TABLE A-2. (Continued)

Heavy-Hazard Trucks
Out-of-State Registered
Federal Engines

Model Year	Oxides of Nitrogen (g/BHP-hr.)			Unburned Hydrocarbons (g/BHP-hr.)			Particulate Matter (g/BHP-hr.)			Fuel Consumption (lb/BHP-hr.)		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1968	9.00	0.28	9.28	3.1%	0.80	0.28	1.08	32.2%	0.70	0.72	1.42	103.2%
1969	9.00	0.28	9.28	3.1%	0.80	0.28	1.08	32.2%	0.70	0.72	1.42	103.2%
1970	9.00	0.28	9.28	3.1%	0.80	0.28	1.08	32.2%	0.70	0.72	1.42	103.2%
1971	9.00	0.28	9.28	3.1%	0.80	0.28	1.08	32.2%	0.70	0.72	1.42	103.2%
1972	9.00	0.28	9.28	3.1%	0.80	0.28	1.08	32.2%	0.70	0.72	1.42	103.2%
1973	9.00	0.28	9.28	3.1%	0.80	0.28	1.08	32.2%	0.70	0.72	1.42	103.2%
1974	9.00	0.28	9.28	3.1%	0.80	0.28	1.08	32.2%	0.70	0.72	1.42	103.2%
1975	9.00	0.28	9.28	3.1%	0.80	0.28	1.08	32.2%	0.70	0.72	1.42	103.2%
1976	9.00	0.28	9.28	3.1%	0.80	0.28	1.08	32.2%	0.70	0.72	1.42	103.2%
1977	7.50	0.23	7.73	3.1%	0.80	0.26	1.08	32.2%	0.70	0.72	1.42	103.2%
1978	7.50	0.23	7.73	3.1%	0.80	0.26	1.08	32.2%	0.70	0.72	1.42	103.2%
1979	7.50	0.23	7.73	3.1%	0.80	0.26	1.08	32.2%	0.70	0.72	1.42	103.2%
1980	7.00	0.22	7.22	3.1%	0.80	0.26	1.08	32.2%	0.70	0.72	1.42	103.2%
1981	7.00	0.22	7.22	3.1%	0.80	0.26	1.08	32.2%	0.70	0.72	1.42	103.2%
1982	7.00	0.22	7.22	3.1%	0.80	0.26	1.08	32.2%	0.70	0.72	1.42	103.2%
1983	7.00	0.22	7.22	3.1%	0.80	0.26	1.08	32.2%	0.70	0.72	1.42	103.2%
1984	7.00	0.22	7.22	3.1%	0.80	0.26	1.08	32.2%	0.70	0.72	1.42	103.2%
1985	7.00	0.22	7.22	3.1%	0.80	0.26	1.08	32.2%	0.70	0.72	1.42	103.2%
1986	7.00	0.22	7.22	3.1%	0.80	0.26	1.08	32.2%	0.70	0.72	1.42	103.2%
1987	7.00	0.22	7.22	3.1%	0.80	0.26	1.08	32.2%	0.70	0.72	1.42	103.2%
1988	7.00	0.22	7.22	3.1%	0.80	0.26	1.08	32.2%	0.70	0.72	1.42	103.2%
1989	7.00	0.22	7.22	3.1%	0.80	0.26	1.08	32.2%	0.70	0.72	1.42	103.2%
1990	5.50	0.48	5.98	6.7%	0.80	0.17	0.77	28.2%	0.45	0.41	103.5%	0.00
1991	4.80	0.95	5.75	19.7%	0.80	0.16	0.45	51.5%	0.22	0.27	0.48	123.9%
1992	4.80	0.95	5.75	19.8%	0.80	0.16	0.45	51.5%	0.22	0.27	0.49	123.3%
1993	4.80	0.95	5.75	19.8%	0.80	0.16	0.45	51.5%	0.22	0.27	0.49	123.3%
1994	4.80	0.95	5.75	19.8%	0.80	0.21	0.41	103.5%	0.08	0.30	0.38	376.0%
1995	4.80	0.95	5.75	19.8%	0.80	0.21	0.41	103.5%	0.08	0.30	0.38	376.0%
1996	4.80	0.95	5.75	19.8%	0.80	0.21	0.41	103.5%	0.08	0.30	0.38	376.0%
1997	4.80	0.95	5.75	19.8%	0.80	0.21	0.41	103.5%	0.08	0.30	0.38	376.0%
1998	4.80	0.95	5.75	19.8%	0.80	0.21	0.41	103.5%	0.08	0.30	0.38	376.0%
1999	4.80	0.95	5.75	19.8%	0.80	0.21	0.41	103.5%	0.08	0.30	0.38	376.0%
2000	4.80	0.95	5.75	19.8%	0.80	0.21	0.41	103.5%	0.08	0.30	0.38	376.0%

(Continued)

TABLE A-2. [Continued]

Medium-Heavy Duty Trucks
California Registered
California Engines

Model Year	Oxides of Nitrogen [g/BHP-hr]			Unburned Hydrocarbons [g/BHP-hr]			Particulate Matter [mg/BHP-hr]					
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1966	9.00	0.68	9.68	9.5%	1.10	0.83	1.93	75.7%	0.70	0.82	131.1%	0.47
1967	9.00	0.68	9.38	9.5%	1.10	0.83	1.93	75.7%	0.70	0.92	131.1%	0.47
1968	9.00	0.88	9.88	9.5%	1.10	0.83	1.83	75.7%	0.70	0.92	131.1%	0.47
1969	9.00	0.88	9.96	9.5%	1.10	0.83	1.83	76.7%	0.70	0.92	131.1%	0.47
1970	9.00	0.68	9.68	9.5%	1.10	0.83	1.93	76.7%	0.70	0.82	131.1%	0.47
1971	9.00	0.88	9.88	9.5%	1.10	0.83	1.93	75.7%	0.70	0.92	131.1%	0.47
1972	8.00	0.88	8.88	9.5%	1.10	0.83	1.83	75.7%	0.70	0.92	131.1%	0.47
1973	8.00	0.68	8.68	9.5%	1.10	0.83	1.83	76.7%	0.70	0.82	131.1%	0.47
1974	8.00	0.88	8.88	9.5%	1.10	0.83	1.83	76.7%	0.70	0.82	131.1%	0.47
1975	8.00	0.88	8.88	9.5%	1.10	0.83	1.93	75.7%	0.70	0.92	131.1%	0.47
1976	9.00	0.88	9.88	9.5%	1.10	0.83	1.83	75.7%	0.70	0.92	131.1%	0.47
1977	8.00	0.57	8.57	9.5%	1.10	0.83	1.83	75.7%	0.80	1.18	2.08	1.18
1978	8.00	0.57	8.57	9.5%	1.10	0.83	1.83	75.7%	0.80	1.18	2.08	1.18
1979	8.00	0.57	8.57	9.5%	1.10	0.83	1.83	75.7%	0.80	1.18	2.08	1.18
1980	5.00	0.48	5.48	9.5%	0.90	0.88	1.58	75.7%	0.80	1.05	1.86	0.51
1981	5.00	0.49	5.49	9.5%	0.90	0.88	1.58	75.7%	0.80	1.05	1.85	0.51
1982	5.00	0.48	5.48	9.5%	0.90	0.88	1.58	76.7%	0.90	1.05	1.86	0.51
1983	5.00	0.48	5.48	9.5%	0.90	0.88	1.58	75.7%	0.80	1.05	1.85	0.51
1984	6.00	0.48	6.48	9.5%	0.90	0.88	1.58	75.7%	0.80	1.05	1.85	0.51
1985	5.00	0.48	5.48	9.5%	0.90	0.88	1.58	75.7%	0.90	1.05	1.86	0.51
1986	5.00	0.48	5.48	9.5%	0.90	0.88	1.58	75.7%	0.90	1.05	1.85	0.51
1987	5.00	0.48	5.48	9.5%	0.90	0.88	1.58	75.7%	0.80	1.05	1.85	0.51
1988	5.50	0.47	5.97	9.5%	0.70	0.51	1.21	72.3%	0.65	0.84	1.18	116.7%
1989	5.50	0.47	5.97	9.5%	0.70	0.51	1.21	72.3%	0.65	0.84	1.18	116.7%
1990	5.50	0.47	5.97	9.5%	0.70	0.51	1.21	72.3%	0.65	0.84	1.18	116.7%
1991	4.80	0.63	5.33	11.0%	0.40	0.58	0.98	144.3%	0.22	0.55	0.77	261.5%
1992	4.80	0.53	5.33	11.0%	0.40	0.58	0.98	144.3%	0.22	0.55	0.77	261.5%
1993	4.80	0.63	5.33	11.0%	0.40	0.58	0.98	144.3%	0.22	0.55	0.77	261.5%
1994	4.80	0.58	5.97	12.1%	0.30	0.63	0.83	176.3%	0.08	0.43	0.51	535.1%
1995	4.80	0.58	5.38	12.1%	0.30	0.53	0.83	176.3%	0.08	0.43	0.51	535.1%
1996	4.80	0.58	5.38	12.1%	0.30	0.53	0.83	176.3%	0.08	0.43	0.51	535.1%
1997	4.80	0.58	5.38	12.1%	0.30	0.53	0.83	176.3%	0.08	0.43	0.51	535.1%
1998	4.80	0.58	5.38	12.1%	0.30	0.53	0.83	176.3%	0.08	0.43	0.51	535.1%
1999	4.80	0.58	5.38	12.1%	0.30	0.53	0.83	176.3%	0.08	0.43	0.51	535.1%
2000	4.80	0.58	5.38	12.1%	0.30	0.53	0.83	176.3%	0.08	0.43	0.51	535.1%

(Continued)

TABLE A-2. [Continued]

Medium-Heavy Duty Trucks
California Registered
Federal Engines

Model Year	Oxides of Nitrogen [lb/BHP-hr]			Unburned Hydrocarbons [lb/BHP-hr]			Particulate Matter [lb/BHP-hr]			Fuel Consumption [lb/BHP-hr]		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1966	9.00	0.35	9.35	3.8%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1967	9.00	0.35	9.35	3.9%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1968	9.00	0.35	9.35	3.9%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1969	9.00	0.35	9.35	3.9%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1970	9.00	0.35	9.35	3.9%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1971	9.00	0.35	9.35	3.9%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1972	9.00	0.35	9.35	3.9%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1973	9.00	0.35	9.35	3.9%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1974	9.00	0.35	9.35	3.9%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1975	9.00	0.35	9.35	3.9%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1976	9.00	0.35	9.35	3.9%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1977	7.80	0.28	7.88	3.9%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1978	7.80	0.28	7.88	3.9%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1979	7.80	0.28	7.88	3.9%	1.10	0.83	1.93	75.2%	0.70	0.98	140.4%	0.47
1980	7.50	0.28	7.78	3.9%	0.80	0.88	1.58	75.2%	0.70	0.98	140.4%	0.46
1981	7.50	0.28	7.78	3.9%	0.90	0.88	1.58	75.2%	0.70	0.98	140.4%	0.46
1982	7.50	0.28	7.78	3.9%	0.90	0.88	1.58	75.2%	0.70	0.98	140.4%	0.46
1983	7.50	0.28	7.78	3.9%	0.90	0.88	1.58	75.2%	0.70	0.98	140.4%	0.46
1984	7.50	0.28	7.78	3.9%	0.90	0.88	1.58	75.2%	0.70	0.98	140.4%	0.46
1985	7.50	0.28	7.78	3.9%	0.90	0.88	1.58	75.2%	0.70	0.98	140.4%	0.46
1986	7.50	0.28	7.78	3.9%	0.90	0.88	1.58	75.2%	0.70	0.98	140.4%	0.46
1987	7.50	0.28	7.78	3.9%	0.90	0.88	1.58	75.2%	0.70	0.98	140.4%	0.46
1988	7.00	0.45	7.45	6.4%	0.70	0.51	1.21	73.4%	0.45	0.56	140.4%	0.44
1989	7.00	0.45	7.45	6.4%	0.70	0.51	1.21	73.4%	0.45	0.56	140.4%	0.44
1990	6.50	0.35	6.85	6.4%	0.70	0.51	1.21	73.4%	0.55	0.69	140.4%	0.43
1991	4.80	0.53	5.33	11.0%	0.40	0.58	0.98	144.3%	0.22	0.65	251.5%	0.42
1992	4.80	0.53	5.33	11.0%	0.40	0.58	0.98	144.3%	0.22	0.65	251.5%	0.42
1993	4.80	0.53	5.33	11.0%	0.40	0.58	0.98	144.3%	0.22	0.65	251.5%	0.42
1994	4.80	0.53	5.33	12.1%	0.30	0.53	0.83	175.3%	0.08	0.43	535.1%	0.41
1995	4.80	0.53	5.33	12.1%	0.30	0.53	0.83	175.3%	0.08	0.43	535.1%	0.41
1996	4.80	0.53	5.33	12.1%	0.30	0.53	0.83	175.3%	0.08	0.43	535.1%	0.40
1997	4.80	0.53	5.33	12.1%	0.30	0.53	0.83	175.3%	0.08	0.43	535.1%	0.40
1998	4.80	0.53	5.33	12.1%	0.30	0.53	0.83	175.3%	0.08	0.43	535.1%	0.40
1999	4.80	0.53	5.33	12.1%	0.30	0.53	0.83	175.3%	0.08	0.43	535.1%	0.40
2000	4.80	0.53	5.33	12.1%	0.30	0.53	0.83	175.3%	0.08	0.43	535.1%	0.40

[Continued]

TABLE A-2. (Continued)

Medium-Heavy Duty Trucks
Out-of-State Registered
Federal Engines

Model Year	Oxides of Nitrogen, lb/BHP-hr.			Unburned Hydrocarbons, lb/BHP-hr.			Particulate Matter, lb/BHP-hr.			Fuel Consumption, lb/BHP-hr.		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1986	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1987	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1988	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1989	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1990	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1991	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1992	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1993	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1994	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1995	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1996	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1997	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1998	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1999	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
2000	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1970	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1971	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1972	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1973	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1974	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1975	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1976	0.00	0.38	0.38	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1977	7.60	0.30	7.90	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1978	7.60	0.30	7.90	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1979	7.60	0.30	7.90	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1980	7.60	0.30	7.90	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1981	7.50	0.30	7.80	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1982	7.50	0.30	7.80	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1983	7.50	0.30	7.80	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1984	7.50	0.30	7.80	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1985	7.50	0.30	7.80	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1986	7.50	0.30	7.80	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1987	7.50	0.30	7.80	4.0%	1.10	0.81	1.81	73.2%	0.70	0.87	138.9%	0.47
1988	7.00	0.48	7.48	4.0%	0.86	0.68	1.54	73.2%	0.70	0.87	138.9%	0.47
1989	7.00	0.48	7.48	4.0%	0.86	0.68	1.54	73.2%	0.70	0.87	138.9%	0.47
1990	5.50	0.36	5.86	4.0%	0.70	0.52	1.20	71.4%	0.55	0.68	124.0%	0.40
1991	4.80	0.54	5.34	11.1%	0.40	0.67	1.07	141.3%	0.22	0.55	248.5%	0.42
1992	4.80	0.64	5.34	11.1%	0.40	0.57	0.97	141.3%	0.22	0.56	248.5%	0.41
1993	4.80	0.64	5.34	11.1%	0.40	0.57	0.97	141.3%	0.22	0.56	248.5%	0.41
1994	4.80	0.59	5.39	12.2%	0.30	0.51	0.81	170.3%	0.08	0.42	530.1%	0.41
1995	4.80	0.59	5.39	12.2%	0.30	0.51	0.81	170.3%	0.08	0.42	530.1%	0.41
1996	4.80	0.63	5.38	12.2%	0.30	0.51	0.81	170.3%	0.08	0.42	530.1%	0.40
1997	4.80	0.55	5.38	12.2%	0.30	0.51	0.81	170.3%	0.08	0.42	530.1%	0.40
1998	4.80	0.59	5.39	12.2%	0.30	0.51	0.81	170.3%	0.08	0.42	530.1%	0.40
1999	4.80	0.63	5.39	12.2%	0.30	0.51	0.81	170.3%	0.08	0.42	530.1%	0.40
2000	4.80	0.66	5.38	12.2%	0.30	0.51	0.81	170.3%	0.08	0.42	530.1%	0.40

(Continued)

TABLE A-2. [Continued]

Light-Heavy Duty Trucks
California Registered
California Engines

Model Year	Oxides of Nitrogen [g/BHP-hr]			Unburned Hydrocarbons [g/BHP-hr]			Particulate Matter [g/BHP-hr]			Fuel Consumption [lb/BHP-hr]		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1988	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	82.0%	0.80	0.78	1.58	98.2%
1987	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	82.0%	0.80	0.78	1.58	98.2%
1986	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	82.0%	0.80	0.78	1.58	98.2%
1985	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	82.0%	0.80	0.78	1.58	98.2%
1980	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	82.0%	0.80	0.78	1.58	98.2%
1970	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	82.0%	0.80	0.78	1.58	98.2%
1971	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	82.0%	0.80	0.78	1.58	98.2%
1972	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	82.0%	0.80	0.78	1.58	98.2%
1973	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	82.0%	0.80	0.78	1.58	98.2%
1974	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	82.0%	0.80	0.78	1.58	98.2%
1975	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	82.0%	0.80	0.78	1.58	98.2%
1976	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	82.0%	0.80	0.78	1.58	98.2%
1977	4.00	0.00	4.00	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1978	4.00	0.00	4.00	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1979	4.00	0.00	4.00	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1980	4.50	0.00	4.50	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1981	4.50	0.00	4.50	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1982	4.50	0.00	4.50	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1983	4.50	0.00	4.50	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1984	4.50	0.00	4.50	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1985	4.50	0.00	4.50	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1986	4.50	0.00	4.50	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1987	4.50	0.00	4.50	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1988	5.00	0.00	5.00	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1989	5.00	0.00	5.00	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1990	5.00	0.00	5.00	0.0%	0.80	0.86	1.48	82.0%	0.80	0.78	1.58	98.2%
1991	4.80	0.52	5.32	10.9%	0.40	0.62	1.02	154.8%	0.22	0.82	0.84	282.7%
1992	4.80	0.52	5.32	10.9%	0.40	0.62	1.02	154.8%	0.22	0.82	0.84	282.7%
1993	4.80	0.52	5.32	10.9%	0.40	0.62	1.02	154.8%	0.22	0.82	0.84	282.7%
1994	4.80	0.86	5.66	12.4%	0.30	0.55	0.85	182.8%	0.08	0.44	0.52	548.1%
1995	4.80	0.86	5.66	12.4%	0.30	0.55	0.85	182.8%	0.08	0.44	0.52	548.1%
1996	4.80	0.86	5.66	12.4%	0.30	0.55	0.85	182.8%	0.08	0.44	0.52	548.1%
1997	4.80	0.86	5.66	12.4%	0.30	0.55	0.85	182.8%	0.08	0.44	0.52	548.1%
1998	4.80	0.86	5.66	12.4%	0.30	0.55	0.85	182.8%	0.08	0.44	0.52	548.1%
1999	4.80	0.86	5.66	12.4%	0.30	0.55	0.85	182.8%	0.08	0.44	0.52	548.1%
2000	4.80	0.86	5.66	12.4%	0.30	0.55	0.85	182.8%	0.08	0.44	0.52	548.1%

(Continued)

TABLE A-2. [Continued]

Light-Heavy Duty Trucks
California Registered
Federal Engines

Model Year	Oxides of Nitrogen [g/BHP-hr]			Unburned Hydrocarbons [g/BHP-hr]			Particulate Matter [g/BHP-hr]			Fuel Consumption [lb/BHP-hr]		
	Base	Delta	Total	% Iner.	Base	Delta	Total	% Iner.	Base	Delta	Total	% Iner.
1868	8.00	0.00	8.00	0.0%	1.10	0.00	2.00	62.0%	0.80	-0.81	1.81	0.0%
1867	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	62.0%	0.80	-0.81	1.81	0.0%
1868	9.00	0.00	9.00	0.0%	1.10	0.80	2.00	62.0%	0.80	-0.81	1.81	0.0%
1869	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	62.0%	0.80	-0.81	1.81	0.0%
1870	9.00	0.00	9.00	0.0%	1.10	0.00	2.00	62.0%	0.80	-0.81	1.81	0.0%
1871	9.00	0.00	9.00	0.0%	1.10	0.80	2.00	62.0%	0.80	-0.81	1.81	0.0%
1872	9.00	0.00	9.00	0.0%	1.10	0.80	2.00	62.0%	0.80	-0.81	1.81	0.0%
1873	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	62.0%	0.80	-0.81	1.81	0.0%
1874	9.00	0.00	9.00	0.0%	1.10	0.90	2.00	62.0%	0.80	-0.81	1.81	0.0%
1875	9.00	0.00	9.00	0.0%	1.10	0.80	2.00	62.0%	0.80	-0.81	1.81	0.0%
1876	9.00	0.00	9.00	0.0%	1.10	0.80	2.00	62.0%	0.80	-0.81	1.81	0.0%
1877	4.00	0.00	4.00	0.0%	0.80	0.88	1.48	82.0%	0.80	-0.81	1.81	0.0%
1878	4.00	0.00	4.00	0.0%	0.80	0.68	1.48	82.0%	0.80	-0.81	1.81	0.0%
1879	4.00	0.00	4.00	0.0%	0.80	0.68	1.48	82.0%	0.80	-0.81	1.81	0.0%
1880	4.50	0.00	4.50	0.0%	0.80	0.68	1.48	82.0%	0.80	-0.81	1.81	0.0%
1881	4.50	0.00	4.50	0.0%	0.80	0.88	1.48	82.0%	0.80	-0.81	1.81	0.0%
1882	4.50	0.00	4.50	0.0%	0.80	0.68	1.48	82.0%	0.80	-0.81	1.81	0.0%
1883	4.50	0.00	4.50	0.0%	0.80	0.68	1.48	82.0%	0.80	-0.81	1.81	0.0%
1884	4.50	0.00	4.50	0.0%	0.80	0.68	1.48	82.0%	0.80	-0.81	1.81	0.0%
1885	4.50	0.00	4.50	0.0%	0.80	0.68	1.48	82.0%	0.80	-0.81	1.81	0.0%
1886	4.50	0.00	4.50	0.0%	0.80	0.68	1.48	82.0%	0.80	-0.81	1.81	0.0%
1887	4.50	0.00	4.50	0.0%	0.80	0.68	1.48	82.0%	0.80	-0.81	1.81	0.0%
1888	5.50	0.12	5.62	2.3%	0.80	0.68	1.48	82.0%	0.80	-0.81	1.81	0.0%
1889	5.50	0.12	5.62	2.3%	0.70	0.57	1.27	81.2%	0.55	-0.57	1.12	104.1%
1890	5.50	0.12	5.62	2.3%	0.70	0.57	1.27	81.2%	0.55	-0.57	1.12	104.1%
1891	4.80	0.52	5.32	10.9%	0.40	0.62	1.02	154.8%	0.22	0.62	0.84	282.7%
1892	4.80	0.52	5.32	10.9%	0.40	0.62	1.02	154.8%	0.22	0.62	0.84	282.7%
1893	4.80	0.52	5.32	10.9%	0.40	0.62	1.02	154.8%	0.22	0.62	0.84	282.7%
1894	4.80	0.52	5.32	10.9%	0.40	0.62	1.02	154.8%	0.22	0.62	0.84	282.7%
1895	4.80	0.52	5.32	10.9%	0.40	0.62	1.02	154.8%	0.22	0.62	0.84	282.7%
1896	4.80	0.52	5.32	10.9%	0.40	0.62	1.02	154.8%	0.22	0.62	0.84	282.7%
1897	4.80	0.52	5.32	10.9%	0.40	0.62	1.02	154.8%	0.22	0.62	0.84	282.7%
1898	4.80	0.52	5.32	10.9%	0.40	0.62	1.02	154.8%	0.22	0.62	0.84	282.7%
1899	4.80	0.52	5.32	10.9%	0.40	0.62	1.02	154.8%	0.22	0.62	0.84	282.7%
2000	4.80	0.52	5.32	10.9%	0.40	0.62	1.02	154.8%	0.22	0.62	0.84	282.7%

[Continued]

TABLE A-2. [Continued]

**Light-Heavy Duty Trucks
Out-of-State Registered
Federal Engines**

Model Year	Oxides of Nitrogen [g/BHP-hr]			Unburned Hydrocarbons [g/BHP-hr]			Particulate Matter [g/BHP-hr]			Fuel Consumption [lb/BHP-hr]		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1986	9.00	0.01	9.01	0.1%	1.10	0.39	1.39	80.0%	0.80	1.60	88.7%	0.53
1987	9.00	0.01	9.01	0.1%	1.10	0.89	1.99	80.0%	0.80	1.60	99.7%	0.53
1988	9.00	0.01	9.01	0.1%	1.10	0.89	1.98	80.0%	0.80	1.60	99.7%	0.53
1989	8.00	0.01	8.01	0.1%	1.10	0.89	1.98	80.0%	0.80	1.60	98.7%	0.53
1970	9.00	0.01	9.01	0.1%	1.10	0.88	1.98	80.0%	0.80	1.60	99.7%	0.53
1971	9.00	0.01	9.01	0.1%	1.10	0.88	1.98	80.0%	0.80	1.60	98.7%	0.53
1972	8.00	0.01	8.01	0.1%	1.10	0.88	1.98	80.0%	0.80	1.60	98.7%	0.53
1973	8.00	0.01	8.01	0.1%	1.10	0.88	1.98	80.0%	0.80	1.60	98.7%	0.53
1974	8.00	0.01	8.01	0.1%	1.10	0.88	1.98	80.0%	0.80	1.60	99.7%	0.53
1975	8.00	0.01	8.01	0.1%	1.10	0.88	1.98	80.0%	0.80	1.60	99.7%	0.53
1976	8.00	0.01	8.01	0.1%	1.10	0.88	1.98	80.0%	0.80	1.60	99.7%	0.53
1977	4.00	0.01	4.01	0.1%	0.80	0.84	1.44	80.0%	0.80	1.60	98.7%	0.53
1978	4.00	0.01	4.01	0.1%	0.80	0.84	1.44	80.0%	0.80	1.60	99.7%	0.53
1979	4.00	0.01	4.01	0.1%	0.80	0.64	1.44	80.0%	0.80	1.60	99.7%	0.53
1980	4.50	0.01	4.51	0.1%	0.80	0.84	1.44	80.0%	0.80	1.60	99.7%	0.53
1981	4.50	0.01	4.51	0.1%	0.80	0.84	1.44	80.0%	0.80	1.60	99.7%	0.53
1982	4.50	0.01	4.51	0.1%	0.80	0.84	1.44	80.0%	0.80	1.60	99.7%	0.53
1983	4.50	0.01	4.51	0.1%	0.80	0.84	1.44	80.0%	0.80	1.60	99.7%	0.53
1984	4.50	0.01	4.51	0.1%	0.80	0.84	1.44	80.0%	0.80	1.60	99.7%	0.53
1985	4.50	0.01	4.51	0.1%	0.80	0.84	1.44	80.0%	0.80	1.60	99.7%	0.53
1986	4.50	0.01	4.51	0.1%	0.80	0.84	1.44	80.0%	0.80	1.60	99.7%	0.53
1987	4.50	0.01	4.51	0.1%	0.80	0.84	1.44	80.0%	0.80	1.60	99.7%	0.53
1988	5.50	0.13	5.63	2.4%	0.70	0.56	1.25	79.2%	0.56	0.56	1.11	102.6%
1989	5.50	0.13	5.63	2.4%	0.70	0.55	1.28	78.2%	0.56	0.56	1.11	102.6%
1990	5.50	0.13	5.63	2.4%	0.70	0.55	1.25	78.2%	0.56	0.56	1.11	102.6%
1991	4.80	0.53	5.33	11.0%	0.40	0.81	1.01	151.8%	0.22	0.82	0.84	278.7%
1992	4.80	0.53	5.33	11.0%	0.40	0.81	1.01	151.8%	0.22	0.82	0.84	278.7%
1993	4.80	0.53	5.33	11.0%	0.40	0.81	1.01	151.8%	0.22	0.82	0.84	278.7%
1994	4.80	0.50	5.40	12.6%	0.30	0.53	0.83	177.8%	0.08	0.43	0.51	543.1%
1995	4.80	0.50	5.40	12.6%	0.30	0.53	0.83	177.8%	0.08	0.43	0.51	543.1%
1996	4.80	0.50	5.40	12.6%	0.30	0.53	0.83	177.8%	0.08	0.43	0.51	543.1%
1997	4.80	0.50	5.40	12.6%	0.30	0.53	0.83	177.8%	0.08	0.43	0.51	543.1%
1998	4.80	0.50	5.40	12.6%	0.30	0.53	0.83	177.8%	0.08	0.43	0.51	543.1%
1999	4.80	0.50	5.40	12.6%	0.30	0.53	0.83	177.8%	0.08	0.43	0.51	543.1%
2000	4.80	0.50	5.40	12.6%	0.30	0.53	0.83	177.8%	0.08	0.43	0.51	543.1%

[Continued]

TABLE A-2. (Continued)

Transit Buses
California Registered
California Engines

Model Year	Oxides of Nitrogen [g/BHP-hr]			Unburned Hydrocarbons [g/BHP-hr]			Particulate Matter [lb/BHP-hr]			Fuel Consumption [lb/BHP-hr]		
	Base	Delta	Total % Incr.	Base	Delta	Total % Incr.	Base	Delta	Total % Incr.	Base	Delta	Total % Incr.
1968	9.00	0.82	9.82	6.8%	1.10	0.53	1.63	4.8%	0.80	0.43	1.03	71.5%
1969	9.00	0.82	9.82	6.8%	1.10	0.53	1.63	4.8%	0.80	0.43	1.03	71.5%
1970	9.00	0.82	9.82	6.8%	1.10	0.53	1.63	4.8%	0.80	0.43	1.03	71.5%
1971	9.00	0.82	9.82	6.8%	1.10	0.53	1.63	4.8%	0.80	0.43	1.03	71.5%
1972	8.00	0.82	8.82	6.8%	1.10	0.53	1.63	4.8%	0.80	0.43	1.03	71.5%
1973	8.00	0.82	8.82	6.8%	1.10	0.53	1.63	4.8%	0.80	0.43	1.03	71.5%
1974	8.00	0.82	8.82	6.8%	1.10	0.53	1.63	4.8%	0.80	0.43	1.03	71.5%
1975	8.00	0.82	8.82	6.8%	1.10	0.53	1.63	4.8%	0.80	0.43	1.03	71.5%
1976	8.00	0.82	8.82	6.8%	1.10	0.53	1.63	4.8%	0.80	0.43	1.03	71.5%
1977	8.00	0.41	8.41	6.9%	1.10	0.53	1.63	4.8%	0.76	0.54	1.28	71.5%
1978	8.00	0.41	8.41	6.9%	1.10	0.53	1.63	4.8%	0.75	0.54	1.28	71.5%
1880	5.00	0.34	5.34	6.9%	1.10	0.53	1.63	4.8%	0.75	0.54	1.28	71.5%
1881	5.00	0.34	5.34	6.9%	1.10	0.53	1.63	4.8%	0.75	0.54	1.28	71.5%
1882	5.00	0.34	5.34	6.9%	1.10	0.53	1.63	4.8%	0.75	0.54	1.28	71.5%
1883	5.00	0.34	5.34	6.9%	1.10	0.53	1.63	4.8%	0.75	0.54	1.28	71.5%
1884	5.00	0.34	5.34	6.9%	1.10	0.53	1.63	4.8%	0.75	0.54	1.28	71.5%
1885	5.00	0.34	5.34	6.9%	1.10	0.53	1.63	4.8%	0.75	0.54	1.28	71.5%
1886	5.00	0.34	5.34	6.9%	1.10	0.53	1.63	4.8%	0.75	0.54	1.28	71.5%
1887	5.00	0.34	5.34	6.9%	1.10	0.53	1.63	4.8%	0.75	0.54	1.28	71.5%
1888	5.50	0.08	5.58	1.4%	0.80	0.28	1.08	34.4%	0.45	0.21	0.68	46.8%
1889	5.50	0.08	5.58	1.4%	0.80	0.28	1.08	34.4%	0.45	0.21	0.68	46.8%
1890	5.50	0.08	5.58	1.4%	0.80	0.28	1.08	34.4%	0.45	0.21	0.68	46.8%
1891	4.80	0.13	4.93	2.7%	0.40	0.22	0.62	53.8%	0.08	0.11	0.19	137.7%
1892	4.80	0.13	4.93	2.7%	0.40	0.22	0.62	53.8%	0.08	0.11	0.19	137.7%
1893	4.80	0.13	4.93	2.7%	0.40	0.22	0.62	53.8%	0.08	0.11	0.19	137.7%
1894	4.80	0.13	4.93	2.7%	0.40	0.24	0.84	59.5%	0.08	0.12	0.20	147.1%
1895	4.80	0.13	4.93	2.7%	0.40	0.24	0.84	59.5%	0.08	0.12	0.20	147.1%
1896	4.80	0.13	4.93	2.7%	0.40	0.24	0.84	59.5%	0.08	0.12	0.20	147.1%
1897	4.80	0.13	4.93	2.7%	0.40	0.24	0.84	59.5%	0.08	0.12	0.20	147.1%
1898	4.80	0.13	4.93	2.7%	0.40	0.24	0.84	59.5%	0.08	0.12	0.20	147.1%
1899	4.80	0.13	4.93	2.7%	0.40	0.24	0.84	59.5%	0.08	0.12	0.20	147.1%
2000	4.80	0.13	4.93	2.7%	0.40	0.24	0.84	59.5%	0.08	0.12	0.20	147.1%

(Continued)

TABLE A-2. [Continued]

Transit Buses
California Registered
Federal Engines

Model Year	Oxides of Nitrogen [g/BHP-hr]				Unburned Hydrocarbons [g/BHP-hr]				Particulate Matter [g/BHP-hr]				Fuel Consumption [lb/BHP-hr]			
	Base	Delta	Total	% Inor.	Base	Delta	Total	% Inor.	Base	Delta	Total	% Inor.	Base	Delta	Total	% Inor.
1986	8.00	0.03	8.03	0.3%	1.10	0.47	1.57	42.95	0.90	0.40	1.00	0.47	0.04	0.48	2.8%	
1987	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.81	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1988	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1989	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1970	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1971	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1972	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1973	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1974	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1975	8.00	0.03	8.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1976	8.00	0.03	8.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1977	8.00	0.03	8.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1978	8.00	0.03	8.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1979	8.00	0.03	8.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1980	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1981	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1982	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1983	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1984	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1985	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1986	9.00	0.03	9.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1987	8.00	0.03	8.03	0.3%	1.10	0.47	1.57	42.85	0.90	0.40	1.00	0.47	0.01	0.48	2.8%	
1988	7.50	0.04	7.54	0.5%	0.90	0.27	1.07	33.2X	0.35	0.15	0.50	41.9X	0.41	0.41	1.3%	
1989	7.50	0.04	7.54	0.5%	0.90	0.27	1.07	33.2X	0.35	0.15	0.50	41.9X	0.41	0.41	1.3%	
1990	7.50	0.04	7.54	0.5%	0.90	0.27	1.07	33.2X	0.35	0.15	0.50	41.9X	0.40	0.40	1.3%	
1991	4.80	0.13	4.93	2.7%	0.40	0.21	0.61	51.4X	0.08	0.09	0.17	118.9X	0.42	0.42	0.9%	
1992	4.80	0.13	4.93	2.7%	0.40	0.21	0.61	51.4X	0.08	0.09	0.17	118.9X	0.41	0.41	0.9%	
1993	4.80	0.13	4.93	2.7%	0.40	0.21	0.61	51.4X	0.08	0.09	0.17	118.9X	0.41	0.41	0.9%	
1994	4.80	0.13	4.93	2.7%	0.40	0.21	0.61	53.4X	0.08	0.10	0.18	120.8X	0.41	0.41	0.9%	
1995	4.80	0.13	4.93	2.7%	0.40	0.21	0.61	53.4X	0.08	0.10	0.18	120.8X	0.40	0.40	0.9%	
1996	4.80	0.13	4.93	2.7%	0.40	0.21	0.61	53.4X	0.08	0.10	0.18	120.8X	0.40	0.40	0.9%	
1997	4.80	0.13	4.93	2.7%	0.40	0.21	0.61	53.4X	0.08	0.10	0.18	120.8X	0.40	0.40	0.9%	
1998	4.80	0.13	4.93	2.7%	0.40	0.21	0.61	53.4X	0.08	0.10	0.18	120.8X	0.40	0.40	0.9%	
1999	4.80	0.13	4.93	2.7%	0.40	0.21	0.61	53.4X	0.08	0.10	0.18	120.8X	0.40	0.40	0.9%	
2000	4.80	0.13	4.93	2.7%	0.40	0.21	0.61	53.4X	0.08	0.10	0.18	120.8X	0.40	0.40	0.9%	

TABLE A-3. EMISSION AND FUEL CONSUMPTION FACTORS FOR THE BASELINE CASE: 0/MILE

Heavy-Haul Trucks
California Registered
California Engines

Model Year	Oxides of Nitrogen [lb/mile]			Unburned Hydrocarbons [lb/mile]			Particulate Matter [lb/mile]			Fuel Consumption [lb/mile]		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1986	28.25	2.78	29.05	10.6%	2.33	1.45	3.78	62.35	2.04	3.13	5.17	153.4%
1987	28.73	2.84	29.57	10.6%	2.38	1.48	3.88	62.35	2.08	3.18	5.27	153.4%
1988	27.07	2.88	29.95	10.6%	2.41	1.50	3.91	62.35	2.11	3.23	5.33	153.4%
1989	27.41	2.82	30.32	10.6%	2.44	1.52	3.95	62.35	2.13	3.27	5.40	153.4%
1990	27.75	2.86	30.70	10.6%	2.47	1.54	4.00	62.35	2.16	3.31	5.47	153.4%
1991	28.23	3.00	31.23	10.6%	2.51	1.58	4.07	62.35	2.20	3.37	5.56	153.4%
1992	28.71	3.05	31.76	10.6%	2.55	1.59	4.14	62.35	2.23	3.43	5.66	153.4%
1993	28.92	3.08	32.00	10.6%	2.57	1.60	4.17	62.35	2.26	3.45	5.70	153.4%
1994	29.13	3.10	32.23	10.6%	2.59	1.61	4.20	62.35	2.27	3.48	5.74	153.4%
1995	29.34	3.12	32.48	10.6%	2.61	1.62	4.23	62.35	2.28	3.50	5.78	153.4%
1996	29.75	3.16	32.91	10.6%	2.64	1.65	4.29	62.35	2.31	3.55	5.86	153.4%
1997	20.10	2.14	22.24	10.6%	2.68	1.67	4.35	62.35	2.02	4.02	7.04	153.4%
1998	19.78	2.10	21.88	10.6%	2.64	1.64	4.26	62.35	2.07	4.55	7.52	153.4%
1999	19.82	2.08	21.70	10.6%	2.62	1.63	4.25	62.35	2.04	4.51	7.48	153.4%
1990	18.22	1.73	17.94	10.6%	2.58	1.62	4.21	62.35	2.05	3.58	6.57	153.4%
1991	18.09	1.71	17.78	10.6%	2.57	1.60	4.18	62.35	2.07	3.56	6.52	153.4%
1992	18.95	1.70	17.85	10.6%	2.55	1.59	4.14	62.35	2.05	3.51	6.47	153.4%
1993	18.15	1.72	17.88	10.6%	2.58	1.61	4.19	62.35	2.08	3.56	6.47	153.4%
1994	18.34	1.74	18.08	10.6%	2.61	1.63	4.24	62.35	2.01	4.01	6.92	153.4%
1995	18.64	1.76	18.38	10.6%	2.65	1.65	4.28	62.35	2.05	4.08	6.70	153.4%
1996	18.73	1.78	18.51	10.6%	2.68	1.67	4.34	62.35	2.08	4.11	6.78	153.4%
1997	18.83	1.80	18.73	10.6%	2.71	1.69	4.40	62.35	2.11	4.15	6.88	153.4%
1998	18.91	1.82	18.83	10.6%	2.68	1.61	4.19	62.35	2.03	3.98	6.65	153.4%
1999	18.91	2.33	20.64	12.7%	2.00	1.19	3.18	58.53	1.83	2.39	4.22	150.6%
1990	18.00	2.29	20.29	12.7%	1.98	1.17	3.13	58.53	1.81	2.35	4.15	150.6%
1991	17.70	2.26	19.96	12.7%	1.93	1.15	3.08	59.53	1.77	2.31	4.08	150.6%
1992	17.18	2.24	17.46	15.0%	0.95	1.08	2.03	114.5%	0.70	1.45	2.15	208.4%
1993	17.14	2.24	17.14	15.0%	0.83	1.07	2.00	114.5%	0.68	1.42	2.11	208.4%
1994	17.09	2.23	17.09	15.0%	0.93	1.08	1.98	114.5%	0.68	1.42	2.10	208.4%
1995	17.02	2.22	17.02	15.0%	0.82	1.01	1.82	163.5%	0.25	1.32	1.67	535.6%
1996	16.98	2.20	16.98	15.0%	0.81	1.00	1.82	183.5%	0.25	1.32	1.58	535.6%
1997	16.93	2.19	16.82	15.0%	0.61	1.00	1.81	183.5%	0.24	1.31	1.56	535.6%
1998	16.83	2.18	16.82	15.0%	0.81	1.00	1.81	183.5%	0.24	1.31	1.55	535.6%
1999	16.83	2.19	16.82	15.0%	0.61	1.00	1.81	183.5%	0.24	1.31	1.55	535.6%
2000	16.83	2.19	16.82	15.0%	0.81	1.00	1.81	183.5%	0.24	1.31	1.55	535.6%

(Continued)

TABLE A-3. [Continued]

Heavy-Hd Duty Trucks
California Registered
Federal Engines

Model Year	Oxides of Nitrogen (g/mile)			Unburned Hydrocarbons (g/mile)			Particulate Matter (g/mile)			Fuel Consumption (lb/mile)		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1986	26.26	0.71	26.96	2.7%	2.73	1.20	3.93	61.3%	2.04	2.79	4.83	1.26
1987	28.73	0.72	27.45	2.7%	2.98	1.22	3.80	51.3%	2.08	2.84	4.92	1.27
1988	27.07	0.73	27.80	2.7%	2.71	1.23	3.84	51.3%	2.11	2.88	4.98	1.28
1989	27.41	0.74	28.15	2.7%	2.44	1.25	3.89	51.3%	2.13	2.81	6.04	1.31
1976	27.75	0.75	28.50	2.7%	2.47	1.27	3.73	51.3%	2.18	2.86	5.11	1.32
1977	28.23	0.77	28.89	2.7%	2.51	1.28	3.80	51.3%	2.20	3.00	5.19	1.35
1978	28.71	0.78	29.49	2.7%	2.56	1.31	3.86	51.3%	2.23	3.06	5.28	1.37
1979	28.82	0.78	29.70	2.7%	2.57	1.32	3.89	51.3%	2.25	3.07	5.32	1.38
1974	28.13	0.79	29.82	2.7%	2.59	1.33	3.92	51.3%	2.27	3.09	5.38	1.39
1975	28.34	0.80	30.14	2.7%	2.81	1.34	3.85	51.3%	2.28	3.12	5.40	1.40
1978	28.75	0.81	30.56	2.7%	2.84	1.36	4.00	51.3%	2.31	3.16	5.47	1.42
1977	25.13	0.68	25.81	2.7%	2.68	1.38	4.08	51.3%	2.35	3.20	5.55	1.44
1976	24.72	0.67	25.39	2.7%	2.84	1.35	3.99	51.3%	2.31	3.15	5.48	1.39
1979	25.52	0.88	26.19	2.7%	2.82	1.34	3.96	51.3%	2.29	3.13	5.41	1.38
1980	22.70	0.82	23.32	2.7%	2.59	1.33	3.83	51.3%	2.27	3.10	5.37	1.33
1981	22.52	0.61	23.13	2.7%	2.57	1.32	3.88	51.3%	2.25	3.08	5.33	1.31
1982	22.33	0.61	22.94	2.7%	2.55	1.31	3.86	51.3%	2.23	3.05	5.28	1.29
1983	22.0	0.61	23.22	2.7%	2.58	1.33	3.91	51.3%	2.26	3.09	5.35	1.28
1984	22.98	0.62	23.50	2.7%	2.81	1.34	3.98	51.3%	2.28	3.12	5.41	1.23
1985	23.15	0.83	23.98	2.7%	2.85	1.36	4.00	51.3%	2.31	3.18	5.48	1.26
1986	23.42	0.84	24.08	2.7%	2.89	1.37	4.05	51.3%	2.34	3.20	5.54	1.24
1987	23.70	0.84	24.34	2.7%	2.71	1.38	4.10	51.3%	2.37	3.24	5.61	1.18
1988	23.30	1.93	25.23	9.3%	2.00	0.85	2.84	47.3%	1.60	1.78	3.28	118.8%
1989	22.91	1.99	24.91	8.3%	1.98	0.83	2.88	47.3%	1.47	1.75	3.22	118.8%
1990	17.70	1.46	18.16	8.3%	1.93	0.91	2.84	47.3%	1.77	2.10	3.07	118.9%
1991	16.16	2.94	16.11	18.4%	0.95	0.85	1.80	66.9%	0.70	1.26	1.98	181.1%
1992	14.91	2.99	17.79	19.4%	0.93	0.84	1.77	89.8%	0.69	1.24	1.82	181.1%
1993	14.85	2.88	17.73	18.4%	0.83	0.83	1.78	89.8%	0.68	1.23	1.91	181.1%
1994	14.80	2.86	17.88	18.4%	0.82	0.81	1.52	147.1%	0.25	1.28	1.53	518.8%
1995	14.74	2.85	17.60	18.4%	0.81	0.80	1.52	147.1%	0.25	1.27	1.52	518.8%
1996	14.69	2.84	17.53	18.4%	0.81	0.80	1.51	147.1%	0.24	1.27	1.51	518.8%
1997	14.83	2.63	17.46	18.4%	0.81	0.80	1.51	147.1%	0.24	1.27	1.51	518.8%
1998	14.83	2.83	17.38	18.4%	0.81	0.80	1.51	147.1%	0.24	1.27	1.51	518.8%
1999	14.83	2.83	17.48	18.4%	0.81	0.80	1.51	147.1%	0.24	1.27	1.51	518.8%
2000	14.83	2.83	17.48	18.4%	0.81	0.80	1.51	147.1%	0.24	1.27	1.51	518.8%

[Continued]

TABLE A-3. [Continued]

Heavy-Haul Trucks
Out-of-State Registered
Federal Engines

Model Year	Oxides of Nitrogen (lb/mile)			Unburned Hydrocarbons (lb/mile)			Particulate Matter (lb/mile)			Fuel Consumption (lb/mile)		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1986	20.25	0.82	27.07	3.1%	2.33	0.76	3.09	32.2%	2.04	2.11	4.16	1.25
1987	20.73	0.93	27.56	3.1%	2.38	0.77	3.14	32.2%	2.08	2.15	4.23	1.27
1988	27.07	0.84	27.91	3.1%	2.41	0.78	3.18	32.2%	2.11	2.17	4.28	1.28
1989	27.41	0.86	28.26	3.1%	2.44	0.78	3.22	32.2%	2.13	2.20	4.33	1.31
1990	27.75	0.87	28.81	3.1%	2.47	0.79	3.26	32.2%	2.16	2.23	4.39	1.32
1991	28.23	0.88	29.11	3.1%	2.51	0.81	3.32	32.2%	2.20	2.27	4.48	1.35
1992	28.71	0.90	29.61	3.1%	2.55	0.82	3.37	32.2%	2.23	2.31	4.54	1.37
1993	28.82	0.90	29.82	3.1%	2.57	0.83	3.40	32.2%	2.25	2.32	4.57	1.37
1994	28.13	0.91	30.04	3.1%	2.59	0.83	3.42	32.2%	2.27	2.34	4.60	1.39
1995	28.34	0.92	30.26	3.1%	2.61	0.84	3.45	32.2%	2.28	2.36	4.64	1.40
1996	28.75	0.88	30.87	3.1%	2.64	0.85	3.50	32.2%	2.31	2.39	4.70	1.42
1997	25.13	0.78	25.91	3.1%	2.68	0.86	3.54	32.2%	2.35	2.42	4.77	1.44
1998	24.72	0.77	25.49	3.1%	2.64	0.85	3.49	32.2%	2.31	2.38	4.69	1.38
1999	24.52	0.78	25.29	3.1%	2.62	0.84	3.48	32.2%	2.29	2.36	4.65	1.36
1990	22.70	0.71	23.41	3.1%	2.59	0.84	3.43	32.2%	2.27	2.34	4.61	1.33
1991	22.52	0.70	23.22	3.1%	2.57	0.83	3.40	32.2%	2.25	2.32	4.58	1.32
1992	22.33	0.70	23.03	3.1%	2.55	0.82	3.37	32.2%	2.23	2.31	4.54	1.31
1993	22.80	0.71	23.31	3.1%	2.58	0.83	3.42	32.2%	2.28	2.33	4.59	1.32
1994	22.88	0.71	23.58	3.1%	2.61	0.84	3.48	32.2%	2.29	2.36	4.65	1.33
1995	23.15	0.72	23.87	3.1%	2.65	0.85	3.50	32.2%	2.31	2.39	4.70	1.42
1996	23.42	0.73	24.15	3.1%	2.69	0.86	3.54	32.2%	2.34	2.42	4.76	1.42
1997	23.73	0.74	24.43	3.1%	2.71	0.87	3.58	32.2%	2.37	2.45	4.82	1.43
1998	23.30	0.72	25.33	3.1%	2.67	0.84	3.48	32.2%	2.28	2.36	4.85	1.42
1999	22.91	1.08	24.99	6.7%	2.75	0.55	2.52	28.2%	1.47	1.54	2.81	1.38
1990	17.70	1.54	19.23	8.7%	1.93	0.55	2.48	28.2%	1.77	1.80	3.37	1.37
1991	15.18	3.00	18.18	18.8%	0.86	0.48	1.44	61.6%	0.70	0.68	1.55	123.3%
1992	14.81	2.95	17.36	18.8%	0.93	0.48	1.41	51.6%	0.68	0.84	1.53	123.3%
1993	14.85	2.84	17.79	18.8%	0.93	0.49	1.41	51.6%	0.68	0.84	1.52	123.3%
1994	14.80	2.93	17.73	18.8%	0.92	0.64	1.26	103.5%	0.26	0.93	1.18	376.8%
1995	14.74	2.92	17.66	18.8%	0.81	0.84	1.25	103.6%	0.25	0.93	1.17	376.8%
1996	14.88	2.81	17.59	18.8%	0.61	0.63	1.25	103.6%	0.24	0.92	1.17	376.8%
1997	14.83	2.90	17.53	18.8%	0.61	0.63	1.24	103.5%	0.24	0.92	1.16	376.8%
1998	14.63	2.90	17.53	18.8%	0.61	0.63	1.24	103.5%	0.24	0.92	1.16	376.8%
1999	14.63	2.90	17.53	18.8%	0.61	0.63	1.24	103.5%	0.24	0.92	1.16	376.8%
2000	14.83	2.90	17.53	18.8%	0.61	0.63	1.24	103.5%	0.24	0.92	1.16	376.8%

[Continued]

TABLE A-3. (Continued)

Medium-Heavy Duty Trucks
California Registered
California Engines

Model Year	Oxides of Nitrogen [g/mile]			Unburned Hydrocarbons [g/mile]			Particulate Matter [g/mile]			Fuel Consumption [lb/mile]		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1988	21.20	2.02	23.22	9.5%	2.59	1.86	4.45	76.7%	2.18	3.81	131.1%	1.13
1987	21.98	2.06	23.72	8.5%	2.65	2.00	4.85	76.7%	2.21	3.88	131.1%	1.18
1986	22.48	2.14	24.80	9.5%	2.75	2.08	4.82	75.7%	2.28	4.04	131.1%	1.20
1985	23.28	2.21	25.49	9.5%	2.84	2.15	5.00	75.7%	2.37	4.16	131.1%	1.24
1984	24.08	2.28	26.36	9.5%	2.94	2.23	5.17	75.7%	2.45	4.33	131.1%	1.28
1983	25.03	2.38	27.41	9.5%	3.09	2.22	5.38	75.7%	2.55	4.50	131.1%	1.34
1982	26.00	2.48	28.48	9.5%	3.18	2.41	5.58	75.7%	2.62	4.67	131.1%	1.39
1981	26.74	2.45	28.19	9.5%	3.15	2.38	5.53	75.7%	2.69	4.83	131.1%	1.34
1980	26.48	2.43	27.90	9.5%	3.11	2.38	5.47	75.7%	2.80	4.98	131.1%	1.32
1979	25.22	2.40	27.62	9.5%	3.08	2.33	5.42	76.7%	2.97	4.53	131.1%	1.31
1978	25.48	2.43	27.91	9.5%	3.11	2.38	5.47	75.7%	2.98	4.58	131.1%	1.32
1977	17.16	1.83	18.80	9.5%	3.15	2.38	5.53	75.7%	2.57	3.38	131.1%	1.38
1976	18.86	1.80	20.66	9.5%	3.09	2.34	5.33	75.7%	2.53	3.32	131.1%	1.35
1975	18.71	1.59	18.30	8.5%	3.08	2.32	5.36	75.7%	2.61	3.28	131.1%	1.33
1980	13.81	1.31	15.12	9.5%	2.46	1.88	4.37	75.7%	2.21	2.90	5.11	1.41
1981	13.69	1.30	14.98	9.5%	2.49	1.87	4.33	75.7%	2.19	2.87	5.06	1.39
1982	13.57	1.29	14.86	9.5%	2.44	1.85	4.28	75.7%	2.17	2.85	5.02	1.38
1983	13.02	1.24	14.26	9.5%	2.34	1.77	4.12	76.7%	2.08	2.73	4.82	1.31
1984	12.47	1.19	13.66	9.5%	2.26	1.70	3.84	75.7%	2.00	2.82	4.61	1.21
1985	11.93	1.14	13.08	9.5%	2.15	1.82	3.77	75.7%	1.91	2.50	4.41	1.13
1986	11.39	1.08	12.46	9.5%	2.06	1.55	3.80	76.7%	1.82	2.38	4.21	1.08
1987	10.83	1.03	11.86	9.5%	1.95	1.48	3.42	75.7%	1.73	2.27	4.00	1.01
1988	11.81	1.02	12.83	8.5%	1.52	1.10	2.84	72.9%	1.19	1.39	2.58	116.7%
1989	11.91	1.02	12.93	8.5%	1.52	1.10	2.81	72.9%	1.19	1.39	2.68	116.7%
1990	11.91	1.02	12.93	8.5%	1.52	1.10	2.81	72.9%	1.19	1.38	2.58	116.7%
1991	10.39	1.15	11.54	11.0%	0.97	1.25	2.12	144.3%	0.48	1.20	1.67	251.5%
1992	10.39	1.15	11.54	11.0%	0.87	1.25	2.12	144.3%	0.48	1.20	1.67	251.5%
1993	10.38	1.15	11.51	11.0%	0.88	1.25	2.11	144.3%	0.48	1.18	1.67	251.5%
1994	10.34	1.25	11.58	12.1%	0.85	1.13	1.78	175.5%	0.17	0.92	1.09	535.1%
1995	10.31	1.25	11.58	12.1%	0.94	1.13	1.77	175.5%	0.17	0.92	1.09	535.1%
1996	10.28	1.24	11.53	0.84	1.13	1.77	175.5%	0.17	0.92	1.09	535.1%	0.91
1997	10.28	1.24	11.50	12.1%	0.84	1.12	1.76	175.5%	0.17	0.91	1.09	535.1%
1998	10.26	1.24	11.50	12.1%	0.84	1.12	1.76	175.5%	0.17	0.91	1.09	535.1%
1999	10.26	1.24	11.50	12.1%	0.84	1.12	1.76	175.5%	0.17	0.91	1.09	535.1%
2000	10.26	1.24	11.50	12.1%	0.84	1.12	1.76	175.5%	0.17	0.91	1.09	535.1%

[Continued]

TABLE A-3. [Continued]

Medium-Heavy Duty Trucks
California Registered
Federal Engines

Model Year	Oxides of Nitrogen (lb/mile)			Unburned Hydrocarbons (lb/mile)			Particulate Matter (lb/mile)			Fuel Consumption (lb/mile)				
	Base	Deltas	Total	% Incr.	Base	Deltas	Total	% Incr.	Base	Deltas	Total	% Incr.		
1966	21.20	0.62	22.02	3.9%	2.58	4.54	7.52	1.6%	3.98	140.4%	1.10	0.04		
1967	21.68	0.64	22.50	3.9%	2.85	4.84	7.62	1.6%	4.05	140.4%	1.12	0.04		
1968	22.48	0.87	23.33	3.9%	2.75	2.08	4.81	7.52	2.45	4.20	140.4%	1.17	0.04	
1969	23.28	0.90	24.18	3.9%	2.84	2.14	4.98	7.52	1.91	2.54	140.4%	1.21	0.25	
1970	24.08	0.93	24.98	3.9%	2.94	2.21	5.15	7.52	1.87	2.63	140.4%	1.21	0.04	
1971	25.03	0.97	26.00	3.9%	3.06	2.30	5.38	7.52	1.86	2.73	140.4%	1.30	0.05	
1972	26.00	1.01	27.01	3.9%	3.18	2.39	5.67	7.52	2.02	2.84	140.4%	1.35	0.05	
1973	26.74	1.00	28.74	3.9%	3.15	2.37	5.61	7.52	2.00	2.81	140.4%	1.34	0.05	
1974	26.48	0.99	28.48	3.9%	3.11	2.34	5.48	7.52	1.98	2.76	140.4%	1.32	0.05	
1975	25.22	0.98	28.19	3.9%	3.08	2.32	5.40	7.52	1.88	2.76	140.4%	1.31	0.05	
1976	25.48	0.88	28.47	3.9%	3.11	2.34	5.48	7.52	1.88	2.78	140.4%	1.32	0.05	
1977	21.74	0.84	22.58	3.9%	3.15	2.37	5.51	7.52	2.00	2.91	140.4%	1.34	0.05	
1978	21.35	0.83	22.18	3.9%	3.08	2.32	5.41	7.52	1.87	2.76	140.4%	1.31	0.05	
1979	21.17	0.82	21.98	3.9%	3.08	2.30	5.37	7.52	1.85	2.74	140.4%	1.28	0.05	
1980	20.71	0.80	21.51	3.9%	2.48	1.87	4.36	7.52	1.83	2.72	140.4%	1.27	0.05	
1981	20.54	0.79	21.33	3.9%	2.48	1.85	4.32	7.52	1.82	2.69	140.4%	1.26	0.05	
1982	20.36	0.78	21.14	3.9%	2.44	1.84	4.28	7.52	1.80	2.67	140.4%	1.24	0.05	
1983	18.53	0.78	20.29	3.9%	2.34	1.78	4.11	7.52	1.82	2.56	140.4%	1.21	0.05	
1984	18.71	0.72	19.44	3.9%	2.25	1.69	3.83	7.52	1.85	2.74	140.4%	1.28	0.05	
1985	17.89	0.88	18.58	3.9%	2.15	1.81	3.78	7.52	1.87	2.85	140.4%	1.27	0.05	
1986	17.07	0.66	17.73	3.9%	2.05	1.54	3.59	7.52	1.88	2.83	140.4%	1.26	0.05	
1987	16.24	0.63	16.87	3.9%	1.95	1.47	3.42	7.52	1.82	2.13	140.4%	1.24	0.05	
1988	15.18	0.87	16.13	4.0%	1.43	1.11	2.83	7.52	1.85	2.20	125.5%	0.88	0.03	
1989	15.18	0.97	16.13	4.0%	1.52	1.11	2.83	7.52	0.87	2.20	125.5%	0.87	0.03	
1990	11.81	0.76	12.67	6.4%	1.52	1.11	2.83	7.52	1.19	1.50	125.5%	0.88	0.03	
1991	10.38	1.16	11.54	11.0%	0.87	1.25	2.12	14.4%	3.0%	1.20	1.67	251.5%	0.91	0.01
1992	10.39	1.16	11.54	11.0%	0.87	1.25	2.12	14.4%	3.0%	1.18	1.87	251.5%	0.89	0.01
1993	10.38	1.15	11.51	11.0%	0.86	1.26	2.11	14.4%	3.0%	1.18	1.67	251.5%	0.89	0.01
1994	10.34	1.26	11.59	12.1%	0.85	1.13	1.78	17.5%	3.0%	0.82	1.09	535.1%	0.88	0.01
1995	10.31	1.26	11.56	12.1%	0.84	1.13	1.77	17.5%	3.0%	0.77	0.92	1.09	0.88	0.01
1996	10.28	1.24	11.53	12.1%	0.84	1.13	1.77	17.5%	3.0%	0.77	0.92	1.09	0.88	0.01
1997	10.28	1.24	11.50	12.1%	0.84	1.12	1.78	17.5%	3.0%	0.77	0.91	1.09	0.88	0.01
1998	10.28	1.24	11.50	12.1%	0.84	1.12	1.78	17.5%	3.0%	0.77	0.91	1.09	0.88	0.01
1999	10.28	1.24	11.50	12.1%	0.84	1.12	1.78	17.5%	3.0%	0.77	0.91	1.09	0.88	0.01
2000	10.28	1.24	11.50	12.1%	0.84	1.12	1.78	17.5%	3.0%	0.77	0.91	1.09	0.88	0.01

[Continued]

TABLE A-3. [Continued]

Medium-Heavy Duty Trucks
Out-of-State Registered
Federal Engines

Model Year	Oxides of Nitrogen (g/mile)			Unburned Hydrocarbons (g/mile)			Particulate Matter (g/mile)			Fuel Consumption (lb/mile)		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1966	21.20	0.84	22.04	4.8%	2.69	1.80	4.48	73.2%	1.86	2.29	3.94	1.14
1967	21.86	0.88	22.62	4.0%	2.85	1.94	4.78	73.2%	1.88	2.43	4.03	1.17
1968	22.48	0.89	23.35	4.0%	2.75	2.01	4.76	73.2%	1.75	2.43	4.17	1.21
1969	23.28	0.82	24.19	4.0%	2.84	2.08	4.92	73.2%	1.61	2.51	4.32	1.21
1970	24.06	0.95	25.02	4.0%	2.94	2.15	5.09	73.2%	1.87	2.80	4.47	1.26
1971	25.03	0.89	26.02	4.0%	3.06	2.24	5.98	73.2%	1.95	2.71	4.65	1.30
1972	26.00	1.03	27.03	4.0%	3.18	2.33	5.50	73.2%	2.02	2.81	4.83	1.35
1973	25.74	1.02	28.78	4.0%	3.15	2.30	5.45	73.2%	2.00	2.78	4.78	1.34
1974	25.48	1.01	26.49	4.0%	3.11	2.28	5.35	73.2%	1.88	2.75	4.74	1.32
1975	25.22	1.00	28.22	4.0%	3.08	2.28	5.34	73.2%	1.86	2.73	4.88	1.31
1976	25.48	1.01	28.49	4.0%	3.11	2.28	5.38	73.2%	1.98	2.75	4.74	1.32
1977	21.74	0.88	22.60	4.0%	3.15	2.30	5.45	73.2%	2.00	2.78	4.78	1.34
1978	21.35	0.85	22.20	4.0%	3.09	2.28	5.35	73.2%	1.87	2.73	4.70	1.30
1979	21.17	0.84	22.01	4.0%	3.08	2.24	5.31	73.2%	1.95	2.71	4.86	1.32
1980	20.71	0.82	21.54	4.0%	2.48	1.82	4.31	73.2%	1.83	2.88	4.62	1.27
1981	20.54	0.81	21.35	4.0%	2.48	1.80	4.27	73.2%	1.82	2.88	4.68	1.26
1982	20.39	0.81	21.18	4.0%	2.44	1.78	4.23	73.2%	1.80	2.84	4.54	1.24
1983	19.53	0.78	20.31	4.0%	2.34	1.72	4.08	73.2%	1.82	2.89	4.39	1.21
1984	18.71	0.74	19.45	4.0%	2.25	1.84	3.98	73.2%	1.75	2.43	4.17	1.10
1985	17.89	0.71	18.60	4.0%	2.15	1.57	3.72	73.2%	1.67	2.32	3.88	1.03
1986	17.07	0.68	17.74	4.0%	2.05	1.60	3.55	73.2%	1.59	2.21	3.81	0.98
1987	16.24	0.64	16.88	4.0%	1.95	1.43	3.38	73.2%	1.52	2.11	3.62	0.93
1988	15.18	0.59	16.15	4.0%	1.52	1.08	2.60	71.4%	0.97	1.21	2.18	0.88
1989	15.18	0.59	16.15	4.0%	1.52	1.08	2.80	71.4%	0.97	1.21	2.18	0.87
1990	11.91	0.79	12.89	6.0%	1.62	1.08	2.80	71.4%	1.18	1.48	2.67	1.24
1991	10.39	1.18	11.56	11.1%	0.87	1.22	2.08	141.3%	0.48	1.06	249.5%	0.91
1992	10.39	1.18	11.55	11.1%	0.87	1.22	2.08	141.3%	0.48	1.18	248.5%	0.91
1993	10.36	1.16	11.52	11.1%	0.88	1.22	2.08	141.3%	0.48	1.18	248.5%	0.91
1994	10.34	1.26	11.80	12.2%	0.85	1.10	1.75	170.3%	0.17	0.91	530.1%	0.88
1995	10.31	1.28	11.87	12.2%	0.84	1.10	1.74	170.3%	0.17	0.91	530.1%	0.87
1996	10.28	1.25	11.54	12.2%	0.84	1.09	1.74	170.3%	0.17	0.91	530.1%	0.86
1997	10.26	1.25	11.51	12.2%	0.84	1.09	1.73	170.3%	0.17	0.91	530.1%	0.86
1998	10.26	1.25	11.51	12.2%	0.84	1.09	1.73	170.3%	0.17	0.91	530.1%	0.86
1999	10.26	1.25	11.51	12.2%	0.84	1.09	1.73	170.3%	0.17	0.91	530.1%	0.86
2000	10.26	1.26	11.51	12.2%	0.84	1.09	1.73	170.3%	0.17	0.91	530.1%	0.86

[Continued]

**Light-Heavy Duty Trucks
California Registered
California Engines**

TABLE A-3. (Continued)

Model Year	Oxides of Nitrogen [g/mile]			Unburned Hydrocarbons [g/mile]			Particulate Matter [g/mile]			Fuel Consumption [lb/mile]		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1986	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1987	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1988	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1989	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1990	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1991	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1992	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1993	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1994	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1995	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1996	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1997	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1998	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1999	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
2000	8.98	0.00	8.98	0.0%	1.10	0.90	2.00	82.03	0.90	0.78	1.58	98.2%
1997	4.43	0.55	4.98	12.5%	0.28	0.51	0.78	182.8%	0.07	0.40	0.48	548.1%
1998	4.43	0.55	4.98	12.5%	0.28	0.51	0.78	182.8%	0.07	0.40	0.48	548.1%
1999	4.43	0.55	4.98	12.5%	0.28	0.51	0.78	182.8%	0.07	0.40	0.48	548.1%
2000	4.43	0.55	4.98	12.5%	0.28	0.51	0.78	182.8%	0.07	0.40	0.48	548.1%

[Continued]

TABLE A-3. [Continued]

Light-Heavy Duty Trucks
California Registered
Federal Engines

Model Year	Oxides of Nitrogen [g/mile]			Unburned Hydrocarbons [g/mile]			Particulate Matter [g/mile]			Fuel Consumption [lb/mile]					
	Base	Delta	% Incr.	Base	Delta	% Incr.	Base	Delta	% Incr.	Base	Delta	% Incr.			
1986	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.63	0.01	0.54	2.5%
1987	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%
1988	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%
1989	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%
1990	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%
1991	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%
1992	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%
1993	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%
1994	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%
1995	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%
1996	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%
1997	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%
1998	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%
1999	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%
2000	0.98	0.00	0.98	0.05	1.10	0.90	2.00	82.0%	0.81	1.61	101.2%	0.53	0.01	0.54	2.5%

[Continued]

TABLE A-3. (Continued)

Light-Heavy Duty Trucks
Out-of-State Registered
Federal Engines

Model Year	Oxides of Nitrogen [g/mile]			Unburned Hydrocarbons [g/mile]			Particulate Matter [g/mile]			Fuel Consumption [lb/mile]			
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	
1966	6.88	0.01	6.89	0.1%	1.10	0.88	1.98	80.0%	0.80	1.58	88.7%	0.53	
1967	6.88	0.01	6.89	0.1%	1.10	0.88	1.98	80.0%	0.80	1.58	88.7%	0.53	
1968	6.88	0.01	6.89	0.1%	1.10	0.88	1.98	80.0%	0.80	1.58	88.7%	0.53	
1969	6.88	0.01	6.89	0.1%	1.10	0.88	1.98	80.0%	0.80	1.58	88.7%	0.53	
1970	6.89	0.01	6.89	0.1%	1.10	0.88	1.98	80.0%	0.80	1.58	88.7%	0.53	
1971	6.89	0.01	6.89	0.1%	1.10	0.88	1.98	80.0%	0.80	1.58	88.7%	0.53	
1972	6.89	0.01	6.89	0.1%	1.10	0.88	1.98	80.0%	0.80	1.58	88.7%	0.53	
1973	6.89	0.01	6.89	0.1%	1.10	0.88	1.98	80.0%	0.80	1.58	88.7%	0.53	
1974	6.89	0.01	6.89	0.1%	1.10	0.88	1.98	80.0%	0.80	1.58	88.7%	0.53	
1975	6.89	0.01	6.89	0.1%	1.10	0.88	1.98	80.0%	0.80	1.58	88.7%	0.53	
1976	6.89	0.01	6.89	0.1%	1.10	0.88	1.98	80.0%	0.80	1.58	88.7%	0.53	
1977	6.89	0.01	6.90	0.1%	0.80	0.84	1.44	80.0%	0.80	1.58	88.7%	0.53	
1978	3.99	0.01	4.00	0.1%	0.60	0.64	1.44	80.0%	0.80	1.58	88.7%	0.53	
1979	3.98	0.01	3.97	-0.1%	0.78	0.63	1.43	80.0%	0.78	0.78	88.7%	0.62	
1980	4.43	0.01	4.43	0.1%	0.79	0.63	1.42	80.0%	0.58	0.58	1.18	88.7%	0.52
1981	4.40	0.01	4.40	0.1%	0.78	0.63	1.41	80.0%	0.59	0.58	1.17	88.7%	0.51
1982	4.37	0.01	4.37	0.1%	0.78	0.62	1.40	80.0%	0.58	0.58	1.16	88.7%	0.51
1983	4.36	0.01	4.37	0.1%	0.78	0.62	1.40	80.0%	0.58	0.58	1.16	88.7%	0.51
1984	4.35	0.01	4.36	0.1%	0.77	0.62	1.38	80.0%	0.58	0.58	1.18	88.7%	0.51
1985	4.35	0.01	4.35	0.1%	0.77	0.62	1.38	80.0%	0.58	0.58	1.16	88.7%	0.51
1986	4.34	0.01	4.35	0.1%	0.77	0.62	1.38	80.0%	0.58	0.58	1.16	88.7%	0.51
1987	4.34	0.01	4.34	0.1%	0.77	0.62	1.39	80.0%	0.58	0.58	1.18	88.7%	0.51
1988	5.28	0.13	5.41	2.4%	0.67	0.53	1.20	79.2%	0.63	0.64	1.07	102.8%	0.49
1989	5.28	0.12	5.38	2.4%	0.87	0.53	1.20	78.2%	0.53	0.54	1.07	102.8%	0.47
1990	5.24	0.12	5.36	2.4%	0.87	0.53	1.19	79.2%	0.52	0.54	1.08	102.8%	0.46
1991	4.55	0.60	5.05	11.0%	0.38	0.58	0.95	151.8%	0.21	0.58	0.79	278.7%	0.45
1992	4.53	0.50	5.03	11.0%	0.38	0.57	0.85	151.8%	0.21	0.58	0.79	279.7%	0.44
1993	4.51	0.50	5.01	11.0%	0.38	0.57	0.85	151.8%	0.21	0.58	0.78	278.7%	0.44
1994	4.49	0.68	5.06	12.5%	0.28	0.50	0.78	177.8%	0.07	0.41	0.48	543.1%	0.44
1995	4.47	0.58	5.03	12.5%	0.28	0.50	0.78	177.8%	0.07	0.40	0.49	543.1%	0.43
1996	4.45	0.58	5.00	12.5%	0.28	0.48	0.77	177.8%	0.07	0.40	0.48	543.1%	0.43
1997	4.43	0.65	4.98	12.5%	0.28	0.49	0.77	177.8%	0.07	0.40	0.47	543.1%	0.43
1998	4.43	0.65	4.98	12.5%	0.28	0.49	0.77	177.8%	0.07	0.40	0.47	543.1%	0.43
1999	4.43	0.65	4.98	12.5%	0.28	0.49	0.77	177.8%	0.07	0.40	0.47	543.1%	0.43
2000	4.43	0.65	4.98	12.5%	0.28	0.49	0.77	177.8%	0.07	0.40	0.47	543.1%	0.43

(Continued)

TABLE A-3. [Continued]

Transit Buses
California Registered
California Engines

Model Year	Oxides of Nitrogen (lb/mile)			Unburned Hydrocarbons (lb/mile)			Particulate Matter (lb/mile)			Fuel Consumption (lb/mile)		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1966	36.04	2.49	38.51	6.95	4.40	2.11	6.52	4.40	2.40	1.72	4.12	71.5%
1967	36.04	2.49	38.51	6.95	4.40	2.11	6.52	4.40	2.40	1.72	4.12	71.5%
1968	36.04	2.49	38.51	6.95	4.40	2.11	6.52	4.40	2.40	1.72	4.12	71.5%
1969	36.04	2.49	38.51	6.95	4.40	2.11	6.52	4.40	2.40	1.72	4.12	71.5%
1970	36.04	2.49	38.51	6.95	4.40	2.11	6.52	4.40	2.40	1.72	4.12	71.5%
1971	36.04	2.49	38.51	6.95	4.40	2.11	6.52	4.40	2.40	1.72	4.12	71.5%
1972	36.04	2.49	38.51	6.95	4.40	2.11	6.52	4.40	2.40	1.72	4.12	71.5%
1973	36.04	2.49	38.51	6.95	4.40	2.11	6.52	4.40	2.40	1.72	4.12	71.5%
1974	36.04	2.49	38.51	6.95	4.40	2.11	6.52	4.40	2.40	1.72	4.12	71.5%
1975	36.04	2.49	38.51	6.95	4.40	2.11	6.52	4.40	2.40	1.72	4.12	71.5%
1976	36.04	2.49	38.51	6.95	4.40	2.11	6.52	4.40	2.40	1.72	4.12	71.5%
1977	24.02	1.86	25.88	6.95	4.40	2.11	6.52	4.40	2.40	1.72	4.12	71.5%
1978	24.02	1.86	25.88	6.95	4.40	2.11	6.52	4.40	2.40	1.72	4.12	71.5%
1979	24.00	1.85	25.86	6.95	4.40	2.11	6.51	4.39	2.39	1.72	4.12	71.5%
1980	18.98	1.37	21.35	6.95	4.40	2.11	6.51	4.39	2.39	1.72	4.12	71.5%
1881	19.98	1.37	21.34	6.95	4.38	2.11	6.50	4.38	2.38	1.71	4.15	71.5%
1982	19.95	1.37	21.32	6.95	4.39	2.11	6.49	4.38	2.38	1.71	4.15	71.5%
1983	19.78	1.36	21.12	6.95	4.35	2.09	6.43	4.35	2.35	1.71	4.11	71.5%
1984	18.67	1.36	20.92	6.95	4.31	2.07	6.37	4.30	2.30	1.68	4.08	71.5%
1985	18.38	1.33	20.72	6.95	4.26	2.05	6.31	4.26	2.26	1.68	4.05	71.5%
1986	19.20	1.32	20.52	6.95	4.22	2.03	6.25	4.20	2.20	1.68	4.02	71.5%
1987	19.91	1.31	20.32	6.95	4.18	2.01	6.19	4.18	2.18	1.67	4.00	71.5%
1988	20.88	0.30	21.18	1.45	3.04	1.04	4.08	3.44	1.71	0.80	2.51	46.8%
1989	20.87	0.30	21.17	1.45	3.04	1.04	4.08	3.44	1.71	0.80	2.50	46.8%
1990	20.85	0.30	21.16	1.45	3.03	1.04	4.07	3.43	1.71	0.80	2.50	46.8%
1991	19.17	0.46	18.68	2.73	1.51	0.82	2.33	53.8%	0.30	0.42	0.72	137.7%
1992	18.15	0.46	18.64	2.73	1.51	0.81	2.33	53.8%	0.30	0.42	0.72	137.7%
1993	18.11	0.46	18.59	2.73	1.51	0.81	2.32	53.8%	0.30	0.42	0.72	137.7%
1994	18.09	0.46	18.54	2.73	1.50	0.80	2.40	58.5%	0.30	0.44	0.74	147.1%
1995	18.01	0.46	18.48	2.73	1.50	0.88	2.39	58.5%	0.30	0.44	0.74	147.1%
1996	17.97	0.49	18.44	2.73	1.50	0.89	2.39	58.5%	0.30	0.44	0.74	147.1%
1997	17.92	0.49	18.39	2.73	1.48	0.89	2.38	58.5%	0.30	0.44	0.74	147.1%
1998	17.92	0.48	18.38	2.73	1.49	0.89	2.38	59.5%	0.30	0.44	0.74	147.1%
1999	17.92	0.48	18.39	2.73	1.49	0.89	2.38	59.5%	0.30	0.44	0.74	147.1%
2000	17.92	0.48	18.38	2.73	1.49	0.89	2.38	59.5%	0.30	0.44	0.74	147.1%

(Continued)

TABLE A-3. (Continued)

Transit Buses
California Registered
Federal Engines

Model Year	Oxides of Nitrogen [g/mile]			Unburned Hydrocarbons [g/mile]			Particulate Matter [g/mile]			Fuel Consumption [lb/mile]		
	Base	Delta	Total	Base	Incr.	Total	Base	Delta	Total	Base	Delta	Total
1966	36.04	0.11	36.14	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1967	36.04	0.11	36.14	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1968	36.04	0.11	36.14	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1969	36.04	0.11	36.14	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1970	36.04	0.11	36.14	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1971	36.04	0.11	36.14	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1972	36.04	0.11	36.14	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1973	36.04	0.11	36.14	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1974	36.04	0.11	36.14	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1975	36.04	0.11	36.14	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1976	36.04	0.11	36.14	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1977	36.04	0.11	36.14	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1978	36.04	0.11	36.14	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1979	36.00	0.11	36.11	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1980	35.87	0.11	36.07	0.3%	4.40	1.89	6.28	42.8%	2.40	1.80	4.01	66.8%
1981	35.83	0.11	36.04	0.3%	4.39	1.88	6.27	42.8%	2.40	1.80	4.01	66.8%
1982	35.80	0.11	36.01	0.3%	4.39	1.88	6.27	42.8%	2.40	1.80	4.01	66.8%
1983	35.56	0.10	35.97	0.3%	4.35	1.88	6.21	42.8%	2.40	1.80	4.00	66.8%
1984	35.23	0.10	35.33	0.3%	4.31	1.84	6.15	42.8%	2.40	1.80	4.00	66.8%
1985	34.89	0.10	34.99	0.3%	4.28	1.83	6.08	42.8%	2.33	1.66	3.84	66.8%
1986	34.55	0.10	34.66	0.3%	4.22	1.81	6.03	42.8%	2.30	1.64	3.84	66.8%
1987	34.22	0.10	34.32	0.3%	4.18	1.78	5.97	42.8%	2.28	1.62	3.80	66.8%
1988	28.48	0.16	28.64	0.3%	3.04	1.01	4.06	33.2%	1.33	0.68	0.68	41.8%
1989	28.46	0.16	28.61	0.5%	3.04	1.01	4.04	33.2%	1.33	0.65	0.65	41.8%
1990	28.43	0.16	28.56	0.5%	3.03	1.01	4.04	33.2%	1.33	0.64	0.64	41.8%
1991	18.17	0.48	19.66	2.7%	1.51	0.76	2.29	51.4%	0.30	0.38	0.38	116.8%
1992	18.16	0.48	18.84	2.7%	1.51	0.76	2.29	51.4%	0.30	0.38	0.38	116.8%
1993	18.11	0.48	18.63	2.7%	1.51	0.76	2.28	51.4%	0.30	0.38	0.38	116.8%
1994	18.08	0.48	18.54	2.7%	1.50	0.76	2.29	51.4%	0.30	0.38	0.38	116.8%
1995	18.01	0.48	18.49	2.7%	1.50	0.76	2.30	51.4%	0.30	0.38	0.38	116.8%
1996	17.97	0.48	18.44	2.7%	1.49	0.76	2.29	51.4%	0.30	0.38	0.38	116.8%
1997	17.92	0.48	18.39	2.7%	1.49	0.76	2.29	51.4%	0.30	0.38	0.38	116.8%
1998	17.92	0.48	18.39	2.7%	1.49	0.76	2.29	51.4%	0.30	0.38	0.38	116.8%
1999	17.92	0.48	18.39	2.7%	1.49	0.76	2.29	51.4%	0.30	0.38	0.38	116.8%
2000	17.92	0.48	18.39	2.7%	1.49	0.76	2.29	51.4%	0.30	0.38	0.38	116.8%

TABLE A-4. ESTIMATED ANNUAL VMT BY YEAR AND VEHICLE CLASS BY REGION

Calendar Year	California Registered-California Engines			California Registered-Federal Engines			Out-of-State Registered Federal Engines			Total All Classes		
	Light	Medium	Heavy	Buses	Light	Medium	Heavy	Buses	Light	Medium	Heavy	
1993	329,351	4,587,434	4,549,966	535,088	40,583	1,219,445	4,548,965	251,906	11,410	1,526,367	2,893,807	20,494,219
1995	802,009	5,085,222	4,631,902	586,845	99,125	1,351,768	4,691,902	276,162	27,507	1,632,430	3,318,537	22,763,410
1996	1,009,218	5,246,774	4,894,810	575,089	124,735	1,394,712	4,894,810	270,530	33,586	1,684,046	3,373,062	23,701,462
1997	1,194,696	5,454,006	5,005,129	568,961	147,659	1,449,799	5,085,129	267,746	39,061	1,915,097	3,432,261	24,639,544
1998	1,365,567	5,607,187	5,304,096	566,496	168,778	1,490,497	5,304,096	265,586	44,137	1,963,494	3,456,767	25,577,623
1999	1,529,416	5,810,883	5,460,853	566,367	169,029	1,544,665	5,460,853	266,526	49,463	2,038,599	3,599,060	26,516,705
1990	1,678,065	6,029,091	5,625,819	565,862	207,404	1,602,670	5,625,819	266,253	54,458	2,108,734	3,689,541	27,453,757
1991	1,804,927	6,189,861	5,735,067	561,086	223,081	1,645,138	5,736,067	264,041	59,507	2,154,424	3,739,489	28,111,677
1992	1,923,926	6,348,711	5,861,025	568,203	237,799	1,687,632	5,861,025	262,684	65,283	2,195,090	3,791,205	28,769,572
1993	2,035,411	6,507,267	5,969,984	557,073	251,569	1,729,780	5,969,984	262,152	65,812	2,233,862	3,844,571	29,427,452
1994	2,139,956	6,667,338	6,097,042	557,461	254,489	1,772,330	6,097,042	262,334	68,601	2,265,810	3,892,956	30,085,357
1995	2,241,730	6,865,023	6,170,689	562,137	277,063	1,824,879	6,170,689	264,556	71,779	2,315,953	3,978,741	30,743,223
1996	2,347,844	7,050,713	6,313,385	570,907	290,183	1,874,240	6,313,385	268,662	81,588	2,349,042	4,016,236	31,476,185
1997	2,432,053	7,209,841	6,454,523	576,946	300,591	1,916,540	6,454,523	271,504	84,515	2,402,057	4,106,020	32,209,115
1998	2,516,212	7,378,058	6,590,497	582,392	310,993	1,961,259	6,590,497	274,067	87,439	2,458,104	4,192,519	32,942,047
1999	2,593,542	7,541,342	6,726,540	598,297	320,550	2,004,561	6,726,540	281,552	90,127	2,512,501	4,279,126	33,674,977
2000	2,667,941	7,698,404	6,868,966	612,164	329,745	2,046,411	6,868,966	288,077	92,712	2,564,828	4,369,666	34,407,891

(Continued)

TABLE A-4. [Continued]

ADJUSTED PROJECTED DWT BY YEAR AND WEIGHT CLASS: SOUTH COAST ADMD				California Registered-California Engines				California Registered-Federal Engines				Out-of-State Registered Federal Engines				Total			
Calendar Year	Light	Medium	Heavy	Buses	Light	Medium	Heavy	Buses	Light	Medium	Heavy	Buses	Light	Medium	Heavy	All Classes			
1983	136,108	1,283,028	1,301,142	283,987	16,822	341,058	1,301,142	133,641	4,730	429,515	731,130	5,962,305							
1985	323,870	1,385,547	1,387,393	303,419	40,029	368,310	1,307,393	142,785	11,108	501,676	816,802	6,508,332							
1986	404,432	1,418,543	1,353,513	295,069	49,986	377,108	1,353,513	138,856	13,459	511,867	823,878	6,740,323							
1987	476,476	1,464,556	1,396,492	289,922	58,767	389,312	1,396,492	136,434	15,546	516,733	832,588	6,972,316							
1988	540,062	1,496,197	1,447,462	286,860	66,749	397,723	1,447,462	134,988	17,456	526,459	842,900	7,204,308							
1989	601,464	1,541,863	1,481,870	285,174	74,338	409,862	1,481,870	134,199	19,452	543,524	862,684	7,436,301							
1990	655,634	1,591,772	1,519,010	283,491	81,157	423,129	1,519,010	133,408	21,309	559,417	879,965	7,668,292							
1991	702,079	1,624,253	1,539,594	279,437	86,774	431,766	1,539,594	131,500	22,768	568,149	896,579	7,812,493							
1992	744,161	1,656,883	1,561,623	275,439	91,975	440,429	1,561,623	130,069	24,091	575,620	893,789	7,955,692							
1993	783,086	1,689,178	1,584,878	274,408	96,786	449,022	1,584,878	129,133	25,320	582,664	901,537	8,100,890							
1994	819,126	1,721,941	1,610,389	273,204	101,240	457,731	1,610,389	128,567	26,259	587,996	908,247	8,245,089							
1995	853,938	1,764,432	1,621,968	274,166	105,543	469,026	1,621,968	129,019	27,343	598,105	923,778	8,389,286							
1996	889,031	1,801,353	1,649,588	275,784	109,880	478,842	1,649,588	130,251	30,894	603,036	926,927	8,546,180							
1997	916,296	1,832,771	1,678,002	270,398	113,260	487,192	1,678,002	130,969	31,842	613,551	942,893	8,703,075							
1998	943,456	1,865,537	1,705,132	279,587	116,607	496,168	1,705,132	131,570	32,785	624,895	958,138	8,859,569							
1999	967,699	1,898,521	1,731,852	285,819	119,603	504,670	1,731,852	134,503	33,628	635,562	973,153	9,016,554							
2000	990,904	1,929,193	1,760,403	291,106	122,471	512,823	1,760,403	136,991	34,434	645,830	989,196	9,173,755							

[Continued]

TABLE A-4. (Continued)

Calendar Year	California Registered-California Engines			California Registered-Federal Engines			Out-of-State Registered Federal Engines			Total		
	Light	Medium	Heavy	Buses	Light	Medium	Heavy	Buses	Light	Medium	Heavy	All Classes
1983	49,846	510,671	703,149	154,381	6,161	135,748	703,149	72,650	1,732	219,726	407,672	2,954,883
1985	116,375	541,089	693,220	161,838	14,383	143,834	693,220	76,159	3,991	251,807	446,864	3,142,779
1986	146,068	556,856	721,355	168,191	18,653	149,026	721,355	74,443	4,861	259,240	453,047	3,260,495
1987	172,561	577,670	747,875	166,187	21,358	153,558	747,875	73,500	5,642	261,961	450,060	3,378,216
1988	196,681	592,200	777,865	165,068	24,309	157,420	777,865	72,973	6,357	267,819	467,376	3,495,933
1989	219,876	612,595	799,383	154,748	27,176	162,842	799,383	72,823	7,111	277,551	480,165	3,613,654
1990	240,872	634,606	822,243	154,365	29,771	168,692	822,243	72,543	7,817	286,652	491,466	3,731,370
1991	258,426	649,786	836,251	162,681	31,941	172,728	836,251	71,850	8,377	292,127	496,869	3,807,288
1992	274,776	664,897	850,871	161,516	33,961	176,745	850,871	71,382	8,895	296,895	502,477	3,883,206
1993	289,968	679,792	865,992	160,829	35,839	180,704	865,992	70,979	9,376	301,361	508,271	3,959,121
1994	304,100	694,774	882,213	160,557	37,585	184,687	882,213	70,851	9,749	304,927	513,382	4,035,033
1995	317,937	713,967	891,114	161,522	39,296	189,789	891,114	71,384	10,180	311,063	523,663	4,110,949
1996	331,861	730,802	908,640	163,366	41,017	194,264	908,640	72,172	11,532	314,441	526,812	4,193,547
1997	342,546	744,863	925,930	164,484	42,349	198,002	925,930	72,698	11,907	320,491	536,837	4,276,138
1998	353,441	759,962	942,606	165,475	43,684	202,016	942,606	73,155	12,282	326,987	546,505	4,358,730
1999	363,078	774,165	958,841	169,184	44,875	205,791	958,841	74,910	12,617	333,099	555,918	4,441,321
2000	372,293	787,753	975,983	162,360	46,014	209,402	975,983	76,400	12,937	338,944	565,856	4,523,910

(Continued)

TABLE A-4. [Continued]

Calendar Year	California Registered-California Engines				California Registered-Federal Engines				Out-of-State Registered Federal Engines				Total All Classes
	Light	Medium	Heavy	Buses	Light	Medium	Heavy	Buses	Light	Medium	Heavy		
1983	14,989	227,716	242,101	19,989	1,843	60,532	242,101	9,407	518	79,059	153,143	1,051,317	
1985	37,912	262,800	259,972	22,824	4,686	69,858	259,972	10,741	1,300	98,683	182,838	1,211,585	
1986	49,037	273,026	273,091	22,821	5,937	72,576	273,091	10,598	1,599	102,165	187,127	1,269,757	
1987	57,232	285,637	285,537	22,425	7,074	75,929	285,537	10,563	1,871	104,518	191,639	1,327,951	
1988	65,793	295,339	299,540	22,456	8,132	78,508	299,540	10,567	2,127	107,773	196,360	1,365,135	
1989	74,093	307,758	310,090	22,574	9,158	81,809	310,090	10,623	2,396	112,511	203,217	1,444,319	
1990	81,705	320,924	321,068	22,667	10,098	85,309	321,068	10,667	2,652	116,969	209,376	1,502,501	
1991	89,433	331,499	329,418	22,618	10,930	88,120	329,418	10,644	2,867	120,255	213,545	1,547,747	
1992	94,824	342,084	338,018	22,635	11,720	90,934	338,018	10,552	3,070	123,253	217,785	1,592,991	
1993	100,883	352,599	346,830	22,716	12,469	93,729	346,830	10,590	3,262	126,136	222,093	1,638,235	
1994	105,629	363,197	356,098	22,853	13,179	95,546	356,098	10,754	3,418	128,621	226,096	1,683,479	
1995	112,288	375,931	362,294	23,166	13,878	99,931	362,294	10,902	3,595	132,159	232,282	1,729,721	
1996	118,323	388,463	372,941	23,672	14,624	103,262	372,941	11,140	4,112	134,867	235,906	1,780,250	
1997	123,250	399,444	389,403	24,065	15,233	106,181	389,403	11,320	4,283	138,680	242,524	1,831,777	
1998	128,192	410,937	393,561	24,411	15,844	109,236	393,561	11,488	4,455	142,670	248,950	1,883,304	
1999	132,813	422,194	409,759	25,207	16,416	112,229	403,759	11,862	4,615	146,578	255,401	1,934,831	
2000	137,284	433,075	414,300	25,916	16,968	115,121	414,300	12,195	4,771	150,356	262,089	1,986,356	

(Continued)

TABLE A-4. [Continued]

ADJUSTED PROJECTED DMV BY YEAR AND WEIGHT CLASS: FRESNO COUNTY

Calendar Year	California Registered-California Engines					California Registered-Federal Engines					Out-of-State Registered Federal Engines			Total		
	Light		Medium		Buses	Light		Medium		Heavy	Buses		Light		Medium	Heavy
	Light	Medium	Heavy	Medium	Buses	Light	Medium	Heavy	Medium	Heavy	Buses	Light	Medium	Heavy	Medium	Heavy
1983	7,656	167,736	164,712	8,143	946	41,930	164,712	3,832	266	55,057	112,734	717,724				
1985	19,422	181,615	176,458	9,276	2,401	48,277	176,458	4,356	666	68,564	134,280	821,782				
1986	24,500	187,841	184,638	9,112	3,028	49,332	184,538	4,288	815	70,657	136,818	856,077				
1987	29,066	195,666	192,131	9,035	3,592	52,018	192,131	4,252	950	71,988	139,523	890,372				
1988	33,281	201,532	200,755	9,012	4,113	53,572	200,755	4,241	1,076	73,937	142,395	924,668				
1989	37,335	209,194	207,023	9,024	4,614	55,609	207,023	4,247	1,207	76,889	146,797	958,963				
1990	41,018	217,338	213,561	9,028	5,070	57,773	213,561	4,248	1,331	79,640	150,688	993,258				
1991	44,170	223,354	217,997	8,962	5,459	59,373	217,997	4,217	1,432	81,459	152,904	1,017,323				
1992	47,130	229,360	222,595	8,925	5,825	60,959	222,595	4,200	1,526	83,083	155,179	1,041,388				
1993	49,907	235,305	227,330	8,915	6,168	62,549	227,330	4,196	1,614	84,628	157,508	1,065,452				
1994	52,615	241,295	232,363	8,929	6,491	64,142	232,363	4,202	1,683	85,910	159,624	1,089,517				
1995	55,061	248,569	235,377	9,012	6,805	66,102	235,377	4,241	1,763	87,889	163,285	1,113,581				
1996	57,719	255,625	241,037	9,161	7,134	67,951	241,037	4,311	2,006	89,225	164,972	1,140,178				
1997	59,893	261,465	246,483	9,260	7,391	69,501	246,483	4,358	2,078	91,260	168,700	1,166,774				
1998	61,887	267,619	251,735	9,349	7,649	71,139	251,735	4,400	2,151	93,411	172,294	1,193,370				
1999	63,815	273,652	257,039	9,609	7,887	72,743	257,039	4,522	2,218	95,517	175,925	1,219,956				
2000	65,664	279,428	262,551	9,834	8,116	74,278	262,551	4,628	2,282	97,534	179,697	1,246,562				

[Continued]

TABLE A-4. [Continued]

Calendar Year	California Registered-California Engines				California Registered-Federal Engines				Out-of-State Registered Federal Engines				Total All Classes
	Light		Medium	Heavy	Buses	Light		Medium	Heavy	Buses	Light		Heavy
	Light	Medium	Heavy	Buses	Light	Medium	Heavy	Buses	Light	Medium	Heavy	Buses	Heavy
1983	6,620	214,758	246,162	3,059	819	57,088	242,162	1,439	230	79,902	172,212	1,020,461	
1985	16,484	242,323	254,242	3,414	2,037	64,415	254,242	1,607	565	97,512	201,023	1,137,865	
1986	20,858	251,524	265,832	3,366	2,579	66,861	265,832	1,584	694	100,862	205,554	1,187,557	
1987	24,838	262,888	278,722	3,348	3,070	69,882	278,722	1,576	812	103,085	210,306	1,237,249	
1988	28,517	271,473	292,021	3,349	3,625	72,164	292,021	1,576	922	106,161	215,213	1,286,941	
1989	32,074	282,530	301,923	3,362	3,964	75,103	301,923	1,582	1,037	110,688	222,446	1,336,633	
1990	35,319	294,204	312,174	3,371	4,365	78,206	312,174	1,587	1,146	114,912	228,867	1,386,325	
1991	38,132	313,138	319,492	3,355	4,713	80,581	319,492	1,579	1,236	117,845	232,840	1,422,404	
1992	40,787	312,045	327,024	3,350	5,041	82,949	327,024	1,576	1,320	120,486	236,078	1,458,482	
1993	43,288	320,855	334,733	3,354	5,350	85,291	334,733	1,578	1,400	123,003	240,976	1,494,560	
1994	45,645	329,714	342,862	3,366	5,542	87,646	342,862	1,584	1,463	125,129	244,726	1,530,638	
1995	47,960	340,514	348,050	3,404	5,928	90,516	348,050	1,602	1,536	128,284	250,973	1,566,716	
1996	50,401	350,911	357,307	3,469	6,229	93,280	357,307	1,633	1,751	130,558	254,096	1,606,942	
1997	52,318	359,584	366,061	3,513	6,466	95,586	366,061	1,653	1,818	133,785	260,382	1,647,167	
1998	54,239	368,724	374,534	3,554	6,704	98,015	374,534	1,672	1,885	137,185	266,347	1,687,393	
1999	56,029	377,717	383,116	3,659	6,925	100,406	383,116	1,722	1,947	140,531	272,450	1,727,618	
2000	57,747	386,321	391,971	3,751	7,137	102,693	391,971	1,765	2,007	143,732	278,748	1,767,643	

[Continued]

TABLE A-4. [Continued]

Calendar Year	California Registered-California Engines			California Registered-Federal Engines			Out-of-State Registered Federal Engines			Total		
	Light	Medium	Heavy	Buses	Light	Medium	Heavy	Buses	Light	Medium	Heavy	All Classes
1983	23,641	239,922	170,215	31,848	2,922	63,777	170,215	14,988	822	62,063	98,659	879,072
1985	60,862	280,317	185,043	36,815	7,622	74,615	185,043	17,325	2,087	78,429	119,249	1,047,207
1986	76,663	289,514	193,240	36,114	9,475	76,959	193,240	16,995	2,551	80,719	121,330	1,056,800
1987	90,828	301,198	200,920	35,759	11,226	80,065	200,920	16,928	2,970	82,117	123,562	1,146,393
1988	104,031	310,285	209,999	36,677	12,868	82,484	209,999	16,789	3,362	84,364	126,141	1,195,987
1989	116,660	321,968	216,479	35,713	14,419	85,585	216,479	16,806	3,773	87,702	129,995	1,245,580
1990	128,183	334,535	223,337	35,732	15,843	88,927	223,337	16,915	4,160	90,849	133,464	1,295,173
1991	138,249	344,339	228,336	35,528	17,087	91,533	228,336	16,719	4,481	93,071	135,630	1,333,310
1992	147,777	354,223	233,564	35,444	18,285	94,160	233,564	16,680	4,784	95,893	137,891	1,371,446
1993	156,788	364,111	239,997	35,474	19,378	96,789	238,997	16,634	5,069	97,051	140,233	1,409,582
1994	165,318	374,146	244,789	35,601	20,433	99,457	244,789	16,754	5,300	98,723	142,409	1,447,718
1995	173,570	386,107	249,304	35,981	21,453	102,636	248,304	16,932	5,558	101,135	145,875	1,485,854
1996	182,359	397,822	254,860	36,659	22,540	106,750	254,860	17,251	6,337	102,969	147,721	1,529,080
1997	189,718	408,540	261,672	37,205	23,449	108,599	261,672	17,509	6,593	105,682	151,669	1,572,306
1998	197,058	419,723	268,239	37,706	24,355	111,572	268,239	17,743	6,848	108,574	155,476	1,615,532
1999	203,881	430,632	274,814	38,881	25,199	114,472	274,814	18,297	7,085	111,395	159,287	1,658,758
2000	210,528	441,273	281,697	39,933	26,020	117,300	281,697	18,792	7,316	114,149	163,276	1,701,983

[Continued]

TABLE A-4. (Continued)

Calendar Year	California Registered-California Engines			California Registered-Federal Engines			Out-of-State Registered			Total All Classes	
							Federal Engines				
	Light	Medium	Heavy	Buses	Light	Medium	Heavy	Buses	Light		
1983	4,836	121,757	126,567	2,914	598	32,366	126,567	1,372	168	42,289	
1985	12,968	148,175	143,317	3,509	1,603	39,388	143,317	1,651	445	55,664	
1986	16,483	154,433	151,032	3,474	2,037	41,052	151,032	1,655	549	57,812	
1987	19,692	162,007	168,346	3,468	2,434	43,065	168,346	1,632	644	59,305	
1988	22,693	167,917	166,514	3,481	2,805	44,636	166,514	1,638	733	61,301	
1989	25,605	175,326	172,723	3,507	3,165	46,506	172,723	1,650	828	64,123	
1990	28,284	183,130	179,134	3,527	3,496	49,680	179,134	1,660	918	66,774	
1991	30,668	189,503	184,122	3,526	3,790	50,374	184,122	1,659	994	68,773	
1992	32,938	196,874	189,237	3,534	4,071	52,058	189,237	1,663	1,065	70,683	
1993	35,095	202,197	194,461	3,552	4,338	53,748	194,461	1,672	1,135	72,362	
1994	37,145	208,553	199,934	3,579	4,591	55,441	199,934	1,684	1,191	73,890	
1995	39,165	216,140	203,663	3,632	4,841	57,485	203,663	1,709	1,254	76,016	
1996	41,340	223,727	210,006	3,718	5,109	59,472	210,006	1,749	1,437	77,706	
1997	43,107	230,292	216,124	3,782	5,328	61,217	216,124	1,780	1,498	79,987	
1998	44,879	237,150	222,067	3,842	5,547	63,040	222,067	1,808	1,560	82,369	
1999	46,548	243,915	228,072	3,971	5,753	64,838	228,072	1,869	1,618	84,718	
2000	48,161	250,442	234,251	4,087	5,953	66,573	234,251	1,923	1,674	86,985	

(Cont'd.)

TABLE A-4. [Continued]

Calendar Year	California Registered-California Engines				California Registered-Federal Engines				Out-of-State Registered Federal Engines				Total All Classes
	Light	Medium	Heavy	Buses	Light	Medium	Heavy	Buses	Light	Medium	Heavy		
1983	3,652	60,519	52,178	2,574	453	16,087	52,178	1,212	127	18,066	34,453		241,519
1985	9,092	68,203	54,713	2,871	1,124	18,130	54,713	1,361	312	22,021	40,180		272,709
1986	11,334	69,710	56,545	2,787	1,401	18,531	56,545	1,311	377	22,429	40,457		281,427
1987	13,298	71,820	58,221	2,732	1,644	19,091	58,221	1,286	435	22,596	40,801		290,145
1988	15,091	73,257	60,252	2,699	1,864	19,473	60,252	1,270	487	22,985	41,242		298,863
1989	16,760	75,334	61,554	2,678	2,071	20,025	61,554	1,260	542	23,680	42,121		307,581
1990	18,254	77,589	62,949	2,655	2,256	20,625	62,949	1,250	592	24,315	42,854		316,299
1991	19,456	78,922	63,600	2,610	2,405	20,979	63,600	1,228	631	24,617	43,050		321,096
1992	20,558	80,268	64,311	2,574	2,541	21,334	64,311	1,211	666	24,864	43,266		325,894
1993	21,569	81,579	65,073	2,547	2,666	21,685	65,073	1,199	697	26,093	43,510		330,692
1994	22,496	82,919	65,929	2,528	2,780	22,042	65,929	1,190	721	25,249	43,707		335,490
1995	23,361	84,707	66,200	2,530	2,890	22,517	66,200	1,190	749	25,504	44,319		340,287
1996	24,270	86,224	67,129	2,546	3,000	22,920	67,129	1,198	843	25,739	44,338		345,336
1997	24,924	87,412	68,040	2,561	3,081	23,236	68,040	1,201	866	26,094	44,940		350,385
1998	25,571	88,706	68,894	2,554	3,161	23,580	68,894	1,202	889	26,480	45,504		355,433
1999	26,153	89,965	69,771	2,603	3,232	23,915	69,771	1,225	909	26,856	46,084		360,482
2000	26,701	91,148	70,711	2,643	3,300	24,229	70,711	1,244	928	27,209	46,705		365,530

{Continued}

TABLE A-4. [Continued]

Calendar Year	California Registered-California Engines				California Registered-Federal Engines				Out-of-State Registered Federal Engines				Total All Classes	
	Light	Medium	Heavy	Buses	Light	Medium	Heavy	Buses	Light	Medium	Heavy			
1983	7,379	92,397	71,546	7,036	912	24,561	71,546	3,311	236	25,166	43,437	347,549		
1985	17,511	99,507	71,694	7,497	2,164	26,451	71,694	3,528	601	29,314	48,394	378,354		
1986	22,056	102,625	74,763	7,344	2,722	27,280	74,763	3,456	733	30,127	49,168	395,006		
1987	26,061	106,626	77,531	7,262	3,221	28,344	77,531	3,417	852	30,508	50,006	411,658		
1988	29,863	109,673	81,014	7,234	3,683	29,154	81,014	3,404	963	31,397	50,971	429,310		
1989	33,378	113,657	83,407	7,232	4,125	30,213	83,407	3,403	1,079	32,598	52,462	444,962		
1990	36,625	117,932	85,931	7,226	4,527	31,349	85,931	3,400	1,189	33,721	53,784	464,614		
1991	39,415	121,125	87,665	7,169	4,872	32,198	87,665	3,374	1,278	34,471	54,542	473,773		
1992	42,043	124,339	89,483	7,137	5,195	33,052	89,483	3,359	1,361	35,146	55,334	485,932		
1993	44,514	127,546	91,375	7,128	5,502	33,906	91,375	3,355	1,439	35,795	56,158	498,091		
1994	46,841	130,795	93,400	7,139	5,789	34,769	93,400	3,360	1,502	36,339	56,914	510,250		
1995	49,095	134,745	94,578	7,203	6,068	35,818	94,578	3,390	1,572	37,163	58,199	522,409		
1996	51,469	138,524	96,869	7,323	6,361	36,823	96,869	3,446	1,789	37,730	59,805	535,988		
1997	53,399	141,876	99,182	7,412	6,600	37,714	99,182	3,488	1,856	38,643	60,215	549,566		
1998	55,326	145,392	101,415	7,492	6,838	38,648	101,415	3,525	1,923	39,601	61,570	563,145		
1999	57,115	148,841	103,671	7,709	7,059	39,565	103,671	3,628	1,985	40,540	62,940	576,723		
2000	58,846	152,180	106,032	7,900	7,273	40,453	106,032	3,718	2,045	41,450	64,373	590,304		

[Continued]

TABLE A-4. [Continued]

Calendar Year	California Registered-California Engines				California Registered-Federal Engines				Out-of-State Registered Federal Engines				Total All Classes
	Light		Medium	Heavy	Buses		Light	Medium	Heavy	Buses	Light	Medium	Heavy
	Light	Medium			Light	Medium	Heavy			Light	Medium	Heavy	
1983	1,209	5,721	4,149	12	149	1,521	4,149	5	42	1,505	2,811	21,273	
1985	2,686	5,769	3,893	12	332	1,534	3,893	5	92	1,641	2,933	22,790	
1986	3,339	5,880	4,012	11	413	1,563	4,012	5	111	1,667	2,944	23,957	
1987	3,917	6,058	4,131	11	484	1,610	4,131	5	128	1,679	2,969	25,124	
1988	4,463	6,193	4,284	11	550	1,646	4,284	5	144	1,712	3,008	26,291	
1989	4,961	6,385	4,388	11	613	1,697	4,388	5	160	1,768	3,080	27,458	
1990	5,425	6,602	4,505	11	670	1,755	4,505	5	176	1,823	3,147	28,625	
1991	5,883	6,775	4,592	11	721	1,801	4,592	5	189	1,862	3,189	29,571	
1992	6,221	6,954	4,687	11	759	1,849	4,687	5	201	1,898	3,234	30,516	
1993	6,590	7,137	4,789	11	814	1,897	4,789	5	213	1,934	3,284	31,461	
1994	6,941	7,326	4,899	11	868	1,947	4,899	5	223	1,965	3,332	32,406	
1995	7,283	7,555	4,966	11	900	2,008	4,966	5	233	2,012	3,410	33,351	
1996	7,655	7,787	5,100	11	946	2,070	5,100	5	266	2,048	3,455	34,443	
1997	7,974	8,008	5,243	11	986	2,129	5,243	5	277	2,106	3,552	35,533	
1998	8,293	8,237	5,381	11	1,025	2,190	5,381	5	288	2,166	3,645	36,623	
1999	8,597	8,468	5,524	12	1,063	2,251	5,524	6	299	2,227	3,743	37,713	
2000	8,895	8,694	5,673	12	1,099	2,311	5,673	6	309	2,287	3,844	38,803	

TABLE A-5. BASELINE, TOTAL, AND EXCESS EMISSIONS STATEWIDE BY VEHICLE CLASS

Heavy-Hd Duty Trucks
California Registered
California Engines

Calendar Year	Oxides of Nitrogen (TPD)			Unburned Hydrocarbons (TPD)			Particulate Matter (TPD)			Fuel Consumption [MM gal/yr]		
	Base		Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1985	100.9	10.7	111.7	10.8%	13.0	9.1	21.1	62.3%	13.0	10.8	32.8	169.4%
1986	89.7	10.8	100.4	10.8%	13.5	8.4	21.9	62.3%	13.5	20.7	34.2	163.4%
1987	100.8	10.7	111.7	10.8%	14.2	9.8	23.0	62.3%	14.2	21.8	38.0	163.4%
1988	103.8	11.3	114.9	10.8%	14.3	8.9	23.1	62.0%	14.2	21.5	35.7	161.2%
1989	107.0	12.0	119.0	11.2%	14.3	8.8	23.2	61.7%	14.1	21.0	35.1	148.7%
1990	108.2	12.5	121.6	11.4%	14.3	8.8	23.1	61.6%	14.0	20.4	34.4	146.5%
1991	109.8	13.0	122.7	11.6%	13.5	8.7	22.2	64.2%	13.0	18.3	32.4	148.7%
1992	108.9	13.4	122.3	12.3%	12.0	8.5	21.1	87.8%	11.3	18.0	29.9	151.8%
1993	108.8	13.8	122.4	12.7%	11.8	8.4	20.2	71.3%	10.3	17.0	27.8	155.0%
1994	108.8	14.1	122.8	13.0%	10.9	8.3	19.2	76.1%	9.8	15.9	25.7	163.1%
1995	107.7	14.4	122.1	13.4%	9.9	9.1	18.0	82.1%	8.6	14.8	23.5	173.8%
1996	107.3	14.6	122.0	13.6%	9.0	9.0	17.0	88.2%	7.5	14.0	21.5	188.3%
1997	108.6	15.1	123.5	13.9%	8.4	7.8	16.3	84.9%	6.7	13.3	20.0	200.5%
1998	108.7	16.4	125.1	14.1%	7.8	7.8	15.8	101.1%	5.8	12.8	18.7	216.5%
1999	111.0	16.8	128.8	14.3%	7.4	7.8	15.3	107.8%	5.3	12.4	17.8	234.8%
2000	112.4	16.2	128.6	14.4%	7.0	8.0	14.9	114.0%	4.7	12.0	16.8	253.7%

{Continued}

TABLE A-5. [Continued]

Heavy-Highway Trucks
California Registered
Federal Engines

Calendar Year	Oxides of Nitrogen (TPD)			Unburned Hydrocarbons (TPD)			Particulate Matter (TPD)			Fuel Consumption (MM gal/yr)		
	Base	Delta	% Incr.	Base	Delta	% Incr.	Base	Delta	% Incr.	Base	Delta	% Incr.
1985	123.8	3.4	129.8	2.7%	13.0	0.7	19.7	61.3%	11.4	15.5	28.9	138.6%
1986	125.8	3.4	129.2	2.7%	13.5	0.9	20.4	51.3%	11.9	16.1	27.9	138.6%
1987	130.2	3.5	139.7	2.7%	14.2	7.3	21.4	51.3%	12.4	16.8	29.3	138.6%
1988	134.2	4.8	138.8	3.4%	14.3	7.3	21.6	50.9%	12.3	16.8	28.9	135.0%
1989	138.8	6.8	144.7	4.2%	14.3	7.2	21.6	50.4%	12.1	16.2	28.3	133.1%
1990	137.8	8.5	144.4	4.7%	14.9	7.2	21.4	50.0%	12.2	16.0	28.2	131.2%
1991	134.8	8.2	143.1	6.1%	13.5	7.1	20.8	62.1%	11.5	15.3	26.7	133.2%
1992	130.9	9.8	140.8	7.5%	12.8	0.8	19.5	54.8%	10.5	14.4	24.9	136.2%
1993	127.8	11.4	139.3	8.9%	11.8	0.8	18.8	57.4%	9.8	13.8	23.4	139.0%
1994	125.3	12.8	138.1	10.2%	10.9	0.7	17.8	62.0%	8.8	13.0	21.8	147.5%
1995	122.3	14.2	138.5	11.6%	9.9	0.7	18.8	67.3%	7.7	12.3	20.0	159.3%
1996	119.5	15.2	134.7	12.3%	8.0	0.8	15.7	73.4%	6.8	11.8	18.8	173.4%
1997	118.6	16.4	125.0	13.8%	0.4	0.7	15.1	79.5%	6.1	11.4	17.5	188.7%
1998	118.1	17.4	135.4	14.7%	7.8	0.7	14.8	85.7%	5.4	11.2	16.8	205.8%
1999	117.8	18.3	138.1	15.6%	7.4	0.8	14.1	82.1%	4.9	11.0	15.8	224.2%
2000	118.0	19.2	137.1	18.2%	7.0	0.8	13.8	88.2%	4.4	10.8	15.2	244.1%

[Continued]

TABLE A-5. (Continued)

Heavy-Hd Duty Trucks Out-of-State Registered Federal Engines										Unburned Hydrocarbons (TPD)						Particulate Matter (TPD)						Fuel Consumption (MM gal/yr)					
Calendar Year	Oxides of Nitrogen (TPD)					Base					Base					Base					Base						
	Base	Delta	Total	% Incr.	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.		
1985	78.0	2.5	81.1	3.1%	3.1%	8.3	2.7	10.9	32.2%	7.2	7.5	14.7	103.2%	183.1	7.7	200.8	4.0%										
1986	88.9	2.8	91.7	3.1%	3.1%	9.5	3.1	12.6	32.2%	8.3	8.6	17.0	103.3%	217.3	6.7	226.0	4.0%										
1987	69.7	2.8	82.5	3.1%	3.1%	9.8	3.1	12.9	32.2%	8.5	8.8	17.4	103.2%	216.8	8.7	225.5	4.0%										
1988	90.8	3.5	94.1	3.8%	3.8%	9.8	3.1	12.7	31.6%	8.3	8.5	16.9	102.1%	216.8	8.4	226.0	3.9%										
1989	91.5	4.2	95.7	4.6%	4.6%	9.5	3.0	12.4	31.3%	8.0	8.1	16.1	100.8%	216.1	8.1	224.2	3.8%										
1990	90.8	4.7	95.5	5.1%	5.1%	9.4	2.9	12.3	30.9%	8.0	8.0	16.0	89.4%	218.3	8.0	226.3	3.7%										
1991	88.5	5.8	94.2	6.5%	6.5%	9.8	2.9	11.7	32.0%	7.6	7.5	16.1	100.3%	221.3	7.1	228.4	3.2%										
1992	85.4	6.8	92.2	8.0%	8.0%	9.2	2.7	10.8	33.4%	6.9	7.0	13.9	101.7%	221.0	6.1	227.7	2.8%										
1993	82.8	7.7	90.6	8.4%	8.4%	7.8	2.7	10.3	34.7%	6.3	6.5	12.8	103.0%	221.8	5.3	227.1	2.4%										
1994	80.7	8.8	89.3	10.6%	10.6%	7.0	2.7	9.7	38.0%	5.7	6.2	11.8	108.3%	222.3	4.3	228.5	1.9%										
1995	78.1	9.4	87.5	12.0%	12.0%	8.3	2.7	9.0	42.2%	4.9	5.8	10.7	117.8%	221.4	3.1	224.5	1.4%										
1996	77.0	10.2	87.2	13.2%	13.2%	5.8	2.7	8.9	46.6%	4.4	5.6	10.0	127.4%	223.7	2.2	225.9	1.0%										
1997	75.4	10.7	88.2	14.2%	14.2%	5.3	2.7	8.1	51.2%	3.9	5.3	9.2	138.4%	223.2	1.4	224.6	0.6%										
1998	75.1	11.4	86.5	15.2%	15.2%	5.0	2.8	7.8	55.8%	3.5	5.2	8.7	150.4%	225.8	0.7	226.6	0.3%										
1999	74.8	12.0	86.8	16.0%	16.0%	4.7	2.8	7.5	60.7%	3.1	5.1	8.2	163.7%	228.8	0.1	228.8	0.1%										
2000	75.1	12.5	87.6	16.7%	16.7%	4.4	2.9	7.3	65.3%	2.8	5.0	7.8	177.9%	231.8	(0.4)	231.3	-0.2%										

(Continued)

TABLE A-5. (Continued)

Calendar Year	Oxides of Nitrogen (TPO)			Unburned Hydrocarbons (TPO)			Particulate Matter (TPM)			Fuel Consumption (MM gal/yr)						
	Base	Delta	Total	Base	Delta	Total	% Incr.	Base	Delta	Total	% Inter.	Base	Delta	Total		
1985	78.5	7.5	85.9	8.5%	13.2	10.0	23.2	75.7%	10.9	14.3	25.3	131.1%	303.9	8.8	312.5	2.8%
1986	81.8	7.8	89.6	9.6%	14.0	10.8	24.8	75.7%	11.8	15.5	27.3	131.1%	328.5	9.2	335.7	2.8%
1987	79.8	7.8	87.2	9.6%	13.8	10.5	24.3	75.7%	11.8	15.5	27.3	131.1%	323.9	9.2	333.1	2.8%
1988	78.7	7.5	87.2	9.4%	13.5	10.2	23.8	75.4%	11.8	16.0	28.8	130.0%	321.8	9.0	330.8	2.8%
1989	79.4	7.4	86.9	9.3%	13.1	9.8	22.8	75.1%	11.1	14.3	25.4	128.8%	318.1	8.8	324.8	2.8%
1990	80.6	7.4	88.0	9.1%	12.7	9.5	22.2	74.8%	10.7	13.8	24.3	128.9%	313.5	8.8	322.1	2.7%
1991	80.9	7.5	88.4	9.3%	12.0	9.5	21.5	78.6%	9.8	13.1	23.0	131.3%	315.2	9.2	323.4	2.8%
1992	80.5	7.7	88.2	9.5%	11.2	9.4	20.6	83.9%	9.0	12.4	21.5	137.8%	314.8	7.7	322.3	2.4%
1993	80.2	7.9	88.0	9.6%	10.4	9.4	19.8	80.9%	8.1	11.9	19.9	147.2%	315.2	7.2	322.4	2.3%
1994	80.5	8.1	88.6	10.1%	9.6	9.4	18.0	97.4%	7.1	11.2	18.3	167.4%	316.8	8.5	322.1	2.1%
1995	81.1	8.4	88.5	10.4%	9.8	9.3	18.2	104.5%	8.2	10.8	18.8	170.2%	318.6	5.9	322.5	1.9%
1996	82.2	8.3	91.0	10.7%	9.3	9.3	17.8	112.5%	5.4	10.0	15.4	187.1%	320.1	5.2	325.4	1.8%
1997	83.4	9.1	92.5	10.9%	7.8	9.4	17.2	120.3%	4.7	9.8	14.3	205.6%	323.5	4.7	328.2	1.5%
1998	84.5	9.4	93.9	11.1%	7.4	9.4	16.8	127.8%	4.1	9.3	13.4	228.9%	328.4	4.3	330.8	1.3%
1999	85.8	9.7	95.4	11.3%	7.1	9.5	16.9	135.0%	3.8	9.1	12.7	250.8%	330.5	4.0	334.5	1.2%
2000	87.1	10.0	97.1	11.4%	6.8	9.7	16.5	141.7%	3.2	8.8	12.4	278.6%	335.1	3.7	339.8	1.1%

{Continued}

TABLE A-5. (Continued)

Year	Oxides of Nitrogen (TPD)			Unburned Hydrocarbons (TPD)			Particulate Matter (TPD)			Fuel Consumption [MM gal/yr]		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
					Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1986	27.8	1.1	28.9	3.8%	3.5	2.8	6.1	75.2%	2.5	3.6	6.0	140.4%
1988	29.0	1.2	30.9	3.9%	3.7	2.3	6.0	75.2%	2.7	3.8	6.5	140.4%
1987	28.8	1.1	30.9	3.9%	3.7	2.9	6.4	76.2%	2.7	3.8	6.5	140.4%
1988	29.0	1.2	30.8	4.1%	3.8	2.7	6.3	75.1%	2.8	3.7	6.3	139.4%
1989	29.3	1.3	30.6	4.4%	3.5	2.9	6.1	74.9%	2.5	3.5	6.0	138.0%
1990	28.7	1.4	30.1	4.8%	3.4	2.5	5.9	74.6%	2.5	3.4	5.8	138.0%
1991	27.9	1.5	29.4	5.3%	3.2	2.6	5.7	78.6%	2.3	3.3	5.8	140.7%
1992	26.7	1.6	28.3	6.0%	3.0	2.5	5.5	84.0%	2.1	3.1	5.3	147.4%
1993	26.9	1.7	27.6	6.7%	2.8	2.5	5.3	91.0%	1.9	3.0	4.9	157.0%
1994	25.2	1.8	27.1	7.4%	2.6	2.6	5.1	97.5%	1.7	2.8	4.8	167.9%
1995	24.7	2.0	26.7	8.1%	2.4	2.5	4.8	104.6%	1.5	2.7	4.2	181.4%
1996	24.4	2.1	26.6	8.8%	2.2	2.5	4.7	112.8%	1.3	2.8	3.8	189.3%
1997	24.2	2.3	26.5	9.4%	2.1	2.5	4.6	120.5%	1.1	2.6	3.8	218.8%
1998	24.0	2.4	26.4	9.8%	2.0	2.6	4.5	127.8%	1.0	2.4	3.4	240.0%
1999	24.0	2.5	26.5	10.3%	1.9	2.5	4.4	135.1%	0.9	2.4	3.3	263.8%
2000	24.1	2.6	26.7	10.7%	1.8	2.8	4.4	141.8%	0.8	2.3	3.1	289.5%

(Continued)

TABLE A-5. (Continued)

Medium-Heavy Duty Trucks Out-of-State Registered Federal Engines										Oxides of Nitrogen (TPD)						Unburned Hydrocarbons (TPD)						Particulate Matter (TPD)						Fuel Consumption [MM gal/yr]								
Calendar Year	Base			Delta			% Incr.			Base			Delta			% Incr.			Base			Delta			% Incr.			Base			Delta			% Incr.		
	Total	Delta	%	Total	Delta	%	Total	Delta	%	Total	Delta	%	Total	Delta	%	Total	Delta	%	Total	Delta	%	Total	Delta	%	Total	Delta	%	Total	Delta	%	Total	Delta	%			
1985	34.8	1.4	38.2	4.0%	4.4	3.2	7.8	73.2%	3.2	4.4	7.5	138.8%	84.3	3.4	87.7	3.7%																				
1986	40.4	1.8	42.0	4.0%	6.0	3.7	8.7	73.2%	3.7	5.1	8.8	138.8%	108.9	4.0	112.8	3.7%																				
1987	40.0	1.6	41.6	4.0%	5.0	3.8	8.8	73.2%	3.7	5.1	8.8	138.8%	107.2	3.9	111.1	3.7%																				
1988	39.1	1.7	40.8	4.2%	4.8	3.5	8.2	73.1%	3.5	4.8	8.3	137.9%	104.8	3.8	108.4	3.6%																				
1989	38.7	1.8	40.4	4.5%	4.8	3.3	7.9	72.8%	3.3	4.5	7.9	138.6%	103.1	3.8	106.8	3.6%																				
1990	37.9	1.8	39.8	4.8%	4.5	3.2	7.7	72.8%	3.3	4.4	7.8	134.5%	103.8	3.9	107.1	3.4%																				
1991	38.7	2.0	39.7	5.4%	4.2	3.2	7.4	78.8%	3.0	4.2	7.3	139.1%	104.7	3.3	108.0	3.2%																				
1992	35.0	2.1	37.2	6.1%	3.9	3.2	7.1	81.8%	2.8	4.1	8.8	145.7%	104.8	3.1	107.8	2.8%																				
1993	33.8	2.3	35.9	6.8%	3.8	3.2	8.8	88.7%	2.5	3.9	8.4	155.2%	105.0	2.8	107.8	2.6%																				
1994	32.5	2.5	35.0	7.6%	3.3	3.1	8.4	95.1%	2.2	3.6	5.8	168.0%	105.1	2.5	107.8	2.4%																				
1995	31.8	2.6	34.2	9.2%	3.0	3.1	8.1	102.0%	1.9	3.4	5.3	179.4%	105.0	2.2	107.2	2.1%																				
1996	31.0	2.8	33.7	9.8%	2.8	3.1	5.9	108.7%	1.7	3.3	4.8	187.1%	105.9	1.9	107.8	1.8%																				
1997	30.3	2.9	33.2	9.5%	2.8	3.0	5.6	117.3%	1.4	3.1	4.5	210.3%	108.2	1.7	107.8	1.6%																				
1998	30.1	3.0	33.1	10.0%	2.5	3.1	5.5	124.6%	1.3	3.0	4.3	237.5%	107.8	1.5	109.1	1.4%																				
1999	30.1	3.1	33.2	10.4%	2.4	3.1	5.5	131.5%	1.1	2.9	4.1	261.0%	109.2	1.4	110.8	1.2%																				
2000	30.2	3.3	33.4	10.8%	2.3	3.1	5.4	138.0%	1.0	2.8	3.8	266.5%	111.0	1.2	112.3	1.1%																				

(Continued)

TABLE A-5. [Continued]

Light-Heavy Duty Trucks
California Registered
California Engines

Calendar Year	Oxides of Nitrogen (TPD)			Unburned Hydrocarbons (TPD)			Particulate Matter (TPD)			Fuel Consumption (MM gal/yr)		
	Base	Delta	Total	Base	Delta	Total	Base	Delta	Total	Base	Delta	Total
		% Incr.			% Incr.			% Incr.			% Incr.	
1985	1.8	0.0	1.8	0.05	0.3	0.2	0.5	82.0%	0.2	0.4	98.2%	8.5
1986	3.8	0.0	3.8	0.05	0.7	0.6	1.2	82.0%	0.5	1.0	98.2%	20.7
1987	4.8	0.0	4.8	0.05	0.8	0.7	1.6	82.0%	0.6	1.3	98.2%	26.0
1988	5.9	0.0	5.9	0.45	1.0	0.8	1.8	81.8%	0.8	1.5	98.1%	30.6
1989	7.0	0.0	7.0	0.05	1.1	0.9	2.0	81.2%	0.8	1.7	100.0%	34.9
1990	8.0	0.1	8.1	0.65	1.2	1.0	2.2	80.8%	0.9	1.8	100.7%	38.2
1991	8.8	0.2	9.0	2.2%	1.3	1.1	2.3	88.6%	0.9	1.0	111.1%	41.3
1992	9.4	0.3	9.7	3.6%	1.2	1.2	2.4	83.4%	0.8	1.1	124.0%	43.8
1993	9.9	0.5	10.4	4.7%	1.2	1.2	2.5	88.4%	0.9	1.2	136.0%	48.1
1994	10.4	0.6	11.1	6.6%	1.2	1.3	2.5	105.8%	0.8	1.2	148.8%	48.1
1995	10.8	0.7	11.7	8.8%	1.2	1.3	2.5	112.3%	0.8	1.2	162.8%	50.1
1996	11.4	0.8	12.3	7.8%	1.2	1.4	2.6	118.7%	0.7	1.3	178.2%	51.9
1997	11.9	1.0	12.8	8.3%	1.1	1.4	2.6	125.1%	0.7	1.3	195.3%	53.8
1998	12.2	1.1	13.3	9.9%	1.1	1.5	2.6	131.1%	0.8	1.3	213.1%	55.3
1999	12.8	1.2	13.8	9.5%	1.1	1.5	2.6	138.9%	0.8	1.3	232.2%	56.8
2000	13.0	1.3	14.2	9.9%	1.1	1.5	2.6	142.3%	0.5	1.3	252.3%	58.2

[Continued]

TABLE A-5. [Continued]

Calendar Year	Oxides of Nitrogen (TPO)			Unburned Hydrocarbons (TPO)			Particulate Matter (TPO)			Fuel Consumption (MM gal/yr)						
	Base		Delta	Base		Delta	Base		% Incr.	Base		Delta	% Incr.			
	Base	Delta	% Incr.	Base	Delta	% Incr.	Base	Delta	% Incr.	Base	Delta	Total	% Incr.			
1985	0.2	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.1	101.2%	1.0	0.0	1.4	2.5%	
1986	0.5	0.0	0.5	0.0	0.1	0.1	0.2	0.0	0.1	0.1	101.2%	2.8	0.1	2.6	2.5%	
1987	0.6	0.0	0.6	0.0	0.1	0.1	0.2	0.0	0.1	0.2	101.2%	3.2	0.1	3.3	2.5%	
1988	0.7	0.0	0.7	0.0	0.1	0.1	0.2	0.0	0.1	0.2	101.6%	3.8	0.1	3.9	2.6%	
1989	0.8	0.0	0.9	0.0	0.1	0.1	0.3	0.0	0.1	0.1	102.1%	4.3	0.1	4.4	2.6%	
1990	1.0	0.0	1.0	0.1	0.15	0.2	0.1	0.3	0.1	0.1	0.2	102.4%	4.7	0.1	4.8	2.4%
1991	1.1	0.0	1.1	0.1	0.2	0.2	0.1	0.3	0.1	0.1	0.2	112.7%	5.1	0.1	5.2	2.3%
1992	1.2	0.0	1.2	0.2	0.1	0.2	0.1	0.3	0.1	0.1	0.3	125.5%	5.4	0.1	5.5	2.1%
1993	1.2	0.1	1.3	4.6%	0.2	0.2	0.3	100.0%	0.1	0.2	0.3	137.4%	5.7	0.1	5.8	2.1%
1994	1.3	0.1	1.4	6.0%	0.2	0.2	0.3	108.4%	0.1	0.2	0.3	150.0%	6.8	0.1	6.9	1.9%
1995	1.4	0.1	1.4	6.9%	0.1	0.2	0.3	112.8%	0.1	0.2	0.3	164.1%	8.2	0.1	8.3	1.8%
1996	1.4	0.1	1.5	7.7%	0.1	0.2	0.3	118.2%	0.1	0.2	0.2	178.3%	8.4	0.1	8.5	1.7%
1997	1.5	0.1	1.6	8.4%	0.1	0.2	0.3	125.6%	0.1	0.2	0.2	198.3%	8.7	0.1	8.8	1.6%
1998	1.5	0.1	1.6	9.0%	0.1	0.2	0.3	131.5%	0.1	0.2	0.2	214.0%	8.8	0.1	8.9	1.5%
1999	1.6	0.1	1.7	9.6%	0.1	0.2	0.3	137.3%	0.1	0.2	0.2	239.0%	7.0	0.1	7.1	1.4%
2000	1.6	0.2	1.8	10.0%	0.1	0.2	0.3	142.6%	0.1	0.2	0.2	263.0%	7.2	0.1	7.3	1.3%

[Continued]

TABLE A-5. (Continued)

Light-Heavy Duty Trucks Out-of-State Registered Federal Engines										Particulate Matter (TPD)										Fuel Consumption (MM gal/yr)										
Calendar Year	Oxides of Nitrogen (TPD)					Unburned Hydrocarbons (TPD)					Base					Delta					Total					% Incr.				
	Basis	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.		
1985	0.1	0.0	0.1	0.1%	0.0	0.0	0.0	0.0%	80.0X	0.0	0.0	0.0%	80.7X	0.3	0.3	0.3	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	2.4%	
1986	0.1	0.0	0.1	0.1%	0.0	0.0	0.0	0.0%	80.0X	0.0	0.0	0.0%	80.7X	0.7	0.7	0.7	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	2.4%	
1987	0.2	0.0	0.2	0.1%	0.0	0.0	0.0	0.0%	80.0X	0.0	0.0	0.0%	80.7X	0.9	0.9	0.9	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	2.4%	
1988	0.2	0.0	0.2	0.1%	0.0	0.0	0.0	0.0%	79.9X	0.0	0.0	0.0%	100.1X	1.0	1.0	1.0	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	2.4%	
1989	0.2	0.0	0.2	0.1%	0.0	0.0	0.0	0.0%	79.8X	0.0	0.0	0.0%	100.6X	1.1	1.1	1.1	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	2.3%	
1990	0.3	0.0	0.3	0.2%	0.0	0.0	0.0	0.0%	79.7X	0.0	0.0	0.0%	100.9X	1.2	1.2	1.2	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	2.3%	
1991	0.3	0.0	0.3	0.2%	0.0	0.0	0.0	0.0%	80.2X	0.0	0.0	0.0%	111.1X	1.3	1.3	1.3	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	2.2%	
1992	0.3	0.0	0.3	0.2%	0.0	0.0	0.0	0.0%	81.8X	0.0	0.0	0.0%	123.8X	1.4	1.4	1.4	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	2.1%	
1993	0.3	0.0	0.3	0.2%	0.0	0.0	0.0	0.0%	87.7X	0.0	0.0	0.0%	135.8X	1.5	1.5	1.5	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	2.0%	
1994	0.3	0.0	0.4	0.1%	0.0	0.0	0.0	0.0%	103.9X	0.0	0.0	0.0%	148.1X	1.6	1.6	1.6	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	1.6%	
1995	0.4	0.0	0.4	0.1%	0.0	0.0	0.0	0.0%	110.2X	0.0	0.0	0.0%	162.1X	1.6	1.6	1.6	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	1.7%	
1996	0.4	0.0	0.4	0.1%	0.0	0.0	0.0	0.0%	118.4X	0.0	0.0	0.0%	177.2X	1.7	1.7	1.7	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	1.6%	
1997	0.4	0.0	0.4	0.1%	0.0	0.0	0.0	0.0%	122.8X	0.0	0.0	0.0%	194.1X	1.8	1.8	1.8	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	1.5%	
1998	0.4	0.0	0.5	0.1%	0.0	0.0	0.0	0.0%	128.3X	0.0	0.0	0.0%	211.6X	1.9	1.9	1.9	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	1.4%	
1999	0.4	0.0	0.5	0.1%	0.0	0.0	0.0	0.0%	133.8X	0.0	0.0	0.0%	230.5X	2.0	2.0	2.0	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	1.3%	
2000	0.5	0.0	0.5	0.1%	0.0	0.0	0.0	0.0%	138.0X	0.0	0.0	0.0%	250.3X	2.0	2.0	2.0	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.0%	1.3%	

[Continued]

TABLE A-6. [Continued]

Calendar Year	Oxides of Nitrogen (TPO)			Unburned Hydrocarbons (TPO)			Particulate Matter (TPO)			Fuel Consumption (MM gal/yr)		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1986	16.1	1.1	17.2	8.9%	2.0	1.2	3.0	48.0%	1.5	1.1	2.6	71.5%
1988	16.9	1.2	18.1	8.9%	2.0	1.4	4.2	48.0%	1.7	1.2	2.9	71.5%
1987	16.8	1.1	18.0	8.9%	2.0	1.3	4.1	48.0%	1.6	1.2	2.8	71.5%
1989	15.0	1.0	16.0	9.7%	2.7	1.3	4.0	47.7%	1.6	1.1	2.7	71.0%
1988	14.3	0.9	15.2	8.4%	2.6	1.2	3.9	47.0%	1.6	1.1	2.7	69.9%
1990	13.8	0.8	14.7	8.0%	2.0	1.2	3.0	48.4%	1.5	1.1	2.0	68.7%
1991	13.3	0.9	14.1	8.7%	2.5	1.1	3.6	49.0%	1.5	1.0	2.5	68.2%
1992	12.8	0.7	13.5	5.4%	2.3	1.1	3.4	49.1%	1.4	0.9	2.3	68.6%
1993	12.4	0.6	13.0	5.1%	2.2	1.0	3.2	49.1%	1.2	0.8	2.1	69.0%
1994	12.2	0.6	12.8	4.9%	2.1	1.0	3.1	49.3%	1.1	0.8	1.9	69.6%
1995	12.1	0.5	12.6	4.6%	2.0	0.9	2.9	49.5%	1.1	0.7	1.8	70.3%
1996	12.0	0.5	12.5	4.3%	1.9	0.9	2.8	48.8%	1.0	0.7	1.7	71.1%
1997	12.1	0.5	12.6	4.0%	1.8	0.8	2.6	47.1%	0.9	0.6	1.5	72.1%
1998	12.2	0.5	12.6	3.7%	1.7	0.8	2.5	47.6%	0.8	0.6	1.4	73.4%
1999	12.1	0.4	12.5	3.4%	1.6	0.8	2.3	47.9%	0.7	0.5	1.2	75.0%
2000	12.4	0.4	12.8	3.1%	1.5	0.7	2.2	48.4%	0.6	0.5	1.1	77.0%

[Continued]

TABLE A-5. (Continued)

Calendar Year	Oxides of Nitrogen (TPO)			Unburned Hydrocarbons (TPO)			Particulate Matter (TPO)			Fuel Consumption (MM gal/yr)		
	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.	Base	Delta	Total	% Incr.
1985	21.1	0.4	21.2	0.3%	1.2	0.5	1.7	42.8%	0.7	0.4	1.1	66.0%
1986	23.1	0.1	23.2	0.3%	1.3	0.8	1.9	42.8%	0.7	0.5	1.2	66.0%
1987	22.8	0.1	22.7	-0.3%	1.3	0.8	1.9	42.8%	0.7	0.5	1.2	66.0%
1988	22.2	0.4	22.6	0.3%	1.3	0.5	1.8	42.8%	0.7	0.5	1.1	66.0%
1989	21.8	0.1	21.9	0.3%	1.2	0.5	1.8	42.8%	0.7	0.4	1.1	65.3%
1990	21.4	0.1	21.5	0.3%	1.2	0.5	1.7	41.6%	0.8	0.4	1.1	64.3%
1991	20.9	0.1	21.0	0.4%	1.2	0.5	1.7	41.6%	0.8	0.4	1.0	63.9%
1992	20.0	0.1	20.1	0.5%	1.1	0.5	1.6	41.6%	0.8	0.4	0.9	64.2%
1993	19.2	0.1	19.3	0.6%	1.0	0.4	1.5	41.6%	0.5	0.3	0.9	64.6%
1994	18.4	0.1	18.5	0.7%	1.0	0.4	1.4	42.0%	0.5	0.3	0.8	65.0%
1995	17.7	0.1	17.8	0.6%	0.9	0.4	1.3	42.3%	0.4	0.3	0.7	65.0%
1996	17.1	0.2	17.2	0.9%	0.9	0.4	1.3	42.8%	0.4	0.3	0.7	66.2%
1997	16.6	0.2	16.8	1.0%	0.8	0.4	1.2	43.0%	0.4	0.2	0.6	67.0%
1998	16.1	0.2	16.3	1.2%	0.8	0.3	1.1	43.4%	0.3	0.2	0.6	68.0%
1999	15.5	0.2	15.7	1.3%	0.7	0.3	1.1	43.8%	0.3	0.2	0.5	69.2%
2000	15.2	0.2	15.4	1.3%	0.7	0.3	1.0	44.4%	0.3	0.2	0.5	70.8%

APPENDIX B

References

EMA (1985)	Engine Manufacturer's Association
Dowdall (1985)	Caterpillar Tractor Company
Jorgensen (1986)	Cummins Engine Company, Inc.
Broering (1986)	Cummins Engine Company, Inc.
Feiten (1985)	General Motors Corporation
Sienicki (1986)	Navistar International Corporation

HEAVY-DUTY DIESEL ENGINE
IN-USE EMISSION TESTING MEETING
EMA-CARB STAFF

SEPTEMBER 11, 1985
EL MONTE, CA

AGENDA

I. CURRENT JOINT EMA-EPA IN-USE TEST PROGRAM

- PURPOSE
- SCOPE
- STATUS
- DIFFERENCES BETWEEN THIS PROGRAM AND EPA'S RECALL TESTING

II. RESULTS FROM JOINT EPA-EMA IN-USE TEST PROGRAM

- EMISSION TEST RESULTS
- PROBLEMS ENCOUNTERED
- COST AND MANPOWER REQUIREMENTS

III. STATUS OF EPA'S RECALL TESTING PROGRAM

- PILOT PROGRAM WITH SWRI
- INITIAL PROGRAM USING MVEL

IV. CARB'S PLANS FOR IN-USE TESTING

1692C/1

EPA-EMA IN-USE EMISSION FACTOR
TEST PROGRAM

PURPOSE:

- TO DEVELOP IN-USE EMISSION FACTORS
- TO QUANTIFY IN-USE EMISSION DETERIORATION RATES
FOR PROPERLY MAINTAINED ENGINES

1692C/2

EPA-EMA IN-USE EMISSION FACTOR
TEST PROGRAM

SCOPE:

- ENGINES FROM FIVE U.S. ENGINE MANUFACTURERS
- ENGINE FAMILY SELECTION BASED ON SALES VOLUME*
- SAMPLE SIZE - 1 LIGHT, 12 MEDIUM, 18 HEAVY
- 1979-80 VINTAGE EXCEPT FOR LIGHT-HEAVY ENGINE
- SAMPLE RANDOMLY SELECTED - PRODUCTION ENGINES**
PREVIOUSLY EMISSION AUDITED (13-MODE @ ZERO HOUR EMISSIONS)
- TESTED FOR GASEOUS EMISSION LEVELS - ON BOTH 13 MODE AND
TRANSIENT PROCEDURES

* CUMMINS ENGINE COMPANY DID NOT SUPPLY FULL QUOTA OF ENGINES
(12 REQUIRED, 8 SUPPLIED)

** MANUFACTURER'S UNABLE TO SUPPLY AUDIT ENGINES IN ALL CASES, SEVEN
ENGINES HAD NOT BEEN AUDITED PRIOR TO TEST PROGRAM.

EPA-EMA IN-USE EMISSION FACTOR
TEST PROGRAM

STATUS:

- EPA LABORATORY TESTING COMPLETED (30 ENGINES TESTED).
- ENGINE MANUFACTURER'S CONFIRMATORY TESTS COMPLETED.

1692C/4

EPA-EMA IN-USE TESTING

DIFFERENCES FROM RECALL TESTING

EMISSION FACTOR TESTING:

- TAMPERED ENGINES TESTED AS PART OF SAMPLE
- POORLY MAINTAINED ENGINES TESTED AS PART OF SAMPLE
- REBUILT ENGINES TESTED AS PART OF SAMPLE
- 13-MODE AND TRANSIENT TEST CYCLE BOTH UTILIZED
NO TRANSIENT SMOKE TESTING

1692C/5

**SUMMARY
TAMPERING AND MAINTENANCE**

RADIAN
CORPORATION

<u>TEST NO.</u>	<u>MFG.</u>	<u>MODEL</u>	<u>AS RECEIVED STATUS</u>	<u>AFTER MAINTENANCE STATUS</u>	<u>COMMENT</u>
1	MACK	ENDT676	OK	REP	
2	CAT	3208	OK	REP	
3	IHC	A210F	REP		
4	IHC	A210F	REP		
5	IHC	A180F	REP		
6	MACK	ENDT676	TAMPERED	NON-REP	PUFF LIMITER DISCONNECTED & ENGINE DAMAGED IN SHIPMENT
7	GMC	8V92TA	TAMPERED	REP	ENGINES RECEIVED W/DIFFERENT INJECTORS, GOVERNOR RESET.
8	CUMM	NTC350	TAMPERED	REP	PUFF LIMITER DISCONNECTED.
9	MACK	ETZ675	REP		
10	GMC	6V92TA	OK	REP	
11	GMC	6V92TA	OK	REP	
12	MACK	EM6285	REP		
13	CAT	3406	TAMPERED	REP	FUEL RATE INCREASED BY 14% NO AFTER MAINTENANCE PERFORMED, TIMING RETARDED 3°, SOOT LIMITER RESET
14	CUMM	NTC400	TAMPERED	NON-REP	PUFF LIMITER DISCONNECTED, FUEL RATE INCREASED BY 16%. SOOT LIMITER - NO AIR
15	GMC	8V92TA	TAMPERED	NON-REP	ENGINE RECEIVED W/DIFF. INJECTORS CYLINDER LINERS, AND TURBOCHARGER.
16	GMC	8.2NA	REP		
17	GMC	8.2T	TAMPERED	REP	TIMING ADVANCED 4° - RESET
18	CUMM	NTC290	REP		
19	GMC	8.2T	OK	REP	
20	GMC	6V53T	LOW POWER	NON-REP	FUEL RACKS MISADJUSTED-RESET RACKS, BUT POWER REMAINED LOW.
21	CUMM	NTC300	REP		
22	CAT	3208	TAMPERED	REP	FUEL RATE INCREASED BY 16%, TIMING ADVANCED.9°
23	GMC	6L71	NOT-MAINT.	NON-REP	POOR MAINTENANCE INDICATED, POWER 15% LOW, POWER REMAINED LOW AFTER MAINT. no maint. OK.
24	CAT	3208	REP		
25	CAT	3208	REP		
26	IHC	6.9L	REP?		
27	CUMM	NTC400	REP?	N.A.	ANALYSIS NOT COMPLETE
28	CUMM	NTC300	REP?	N.A.	ANALYSIS NOT COMPLETE
29	CUMM	NTC350	REP?	N.A.	ANALYSIS NOT COMPLETE
30	CUMM	NTC290	REP?	N.A.	ANALYSIS NOT COMPLETE
99	CAT	3208	REP		Soot fuel nozzle

1692C/6

SUMMARY
EMISSION DETERIORATION
EPA-EMA IN-USE EMISSION
TEST PROGRAM
LIGHT HEAVY-DUTY DIESELS
13-MODE STEADY-STATE TEST

<u>TEST NO.</u>	<u>MFG.</u>	<u>MODEL</u>	<u>MILEAGE</u>	<u>NOx(z)</u>	<u>NOx(AR)</u>	<u>NOx(AM)</u>	<u>NOx DR</u>
				G/BHP-HR			
26	IHC	6.9L	47,516	4.27	4.01		-.55
<u>HC (z)</u> <u>HC (AR)</u> <u>HC (AM)</u> <u>HC DF</u>							
				.27		.40	
							+.27

(z) - Zero Hour; (AR) - As Received; (AM) - After Maintenance

DR - Deterioration Rate (g/bhp-hr/100,000 miles) after maintenance - same laboratory, if possible.



SUMMARY
EMISSION DETERIORATION
EPA-EMA IN-USE EMISSION
TEST PROGRAM
MEDIUM HEAVY-DUTY DIESELS
13-MODE STEADY-STATE TEST

<u>TEST NO</u>	<u>MFG.</u>	<u>MODEL</u>	<u>MILEAGE</u>	<u>NOx(z)</u>	<u>NOx(AR)</u>	<u>NOx(AM)</u>	<u>NOx DR</u>
				<u>G/BHP-HR</u>			
2	CAT	3208	122,000	8.58	7.41	7.65	-.76
3	IHC	A210F	62,086	8.09	7.07	-	-1.64
4	IHC	A210F	85,000	7.96	7.75	-	-.25
5	IHC	A180F	29,673	6.08	6.09	-	+.03
16	GMC	8.2NA	72,571	6.01	6.88	-	+1.20
17	GMC	8.2T	70,000	5.09	9.46	5.19	+.14
19	GMC	8.2T	130,000	5.09	6.06	5.98	+.68
20	GMC	6V53T	151,105	8.10	8.64	-	NON REP
22	CAT	3208	100,000	8.38	17.35	8.63	+.25
24	CAT	3208	50,000	-	8.45	-	-
25	CAT	3208	25,000	-	7.72	-	-
99	CAT	3208	50,000	8.79	7.84	-	-1.90
Representative Mean x				7.11	8.43	-	-0.25
				<u>HC(z)</u>	<u>HC(AR)</u>	<u>HC(AM)</u>	<u>HC DF</u>
2				1.01	.83	1.20	+.16
3				.75	.68	-	-.11
4				.81	.56	-	-.29
5				.99	.76	-	-.78
16				.94	.64	-	-.41
17				.52	.74	.65	+.19
19				.52	.46	.60	+.06
20				.94	2.15	-	NON REP
22				1.00	.75	1.04	+.04
24				-	.96	-	-
25				-	.94	-	-
99				1.21	1.36		+.30
Representative Mean x				.86	.75		-.09

(z) - Zero Hour; (AR) - As Received; (AM) - After Maintenance

DR - Deterioration Rate - (g/bhp-hr/100,000 mile) After Maintenance
Same Laboratory, if possible.



**SUMMARY
 EMISSION DETERIORATION
 EPA-EMA IN-USE EMISSION
 TEST PROGRAM
 HEAVY HEAVY-DUTY DIESEL
 13-MODE STEADY-STATE TEST**

<u>TEST NO.</u>	<u>MFG.</u>	<u>MODEL</u>	<u>MILEAGE</u>	<u>NOx(z)</u>	<u>NOx(AR)</u>	<u>NOx(AM)</u>	<u>NOx DR</u>
				G/BHP-HR			
1	MACK	ENDT676	285,346	6.34	7.97	6.51	+ .06
6	MACK	ENDT676	203,185	7.09	6.74	-	NON REP
7	GMC	8V92TA	375,000	7.30	8.20	7.62	+ .09
8	CUMM	NTC 350	273,796	7.37	7.58	10.31	+1.07
9	MACK	ETZ675	225,000	6.56	7.80	-	+. 55
10	GMC	6V92TA	220,000	7.40	8.17	9.80	+1.09
11	GMC	6V92TA	410,000	7.80	7.40	8.36	+ .14
12	MACK	EM6285	194,828	6.71	9.36	-	+1.36
13	CAT	3406	139,000	9.40	7.39	-	-1.45
14	CUMM	NTC400	257,449	7.56	9.14	-	NON REP
15	GMC	8V92TA	400,000	9.00	7.94	-	NON REP
18	CUMM	NTC290	232,784	8.14	9.09	-	+ .41
21	CUMM	NTC300	266,541	7.06	9.24	-	+ .82
23	GMC	6L71	350,000	7.73	6.88	8.22	NON REP
27	CUMM	NTC400	221,038	6.87	10.38		1.59
28	CUMM	NTC300	273,385	8.40	8.02		- .14
29	CUMM	NTC350	95,192	7.35	7.09		- .27
30	CUMM	NTC290	294,953		8.36		NON REP
Representative Mean x			250,490	7.44	8.29		+0.41
				<u>HC(z)</u>	<u>HC(AR)</u>	<u>HC(AM)</u>	<u>HC DF</u>
1				.58	.48	.61	+ .01
6				.52	.51	-	NON REP
7				.60	.54	.56	- .01
8				.28	.26	.22	- .01
9				.50	.43	-	- .03
10				.40	.61	.58	+ .08
11				.30	.64	.54	+ .06
12				.55	.42	-	- .07
13				.39	.38	-	- .01
14				.30	.31	-	NON REP
15				.70	.72	-	NON REP
18				.33	.32	-	.00
21				.34	1.11	-	+ .29
23				.60	.52	.52	NON REP
27				.30	.35		.02
28				.46	.49		.01
29				.23	1.02		.83
30					.41		
Representative Mean x				.40	.53		+ .09

(z) Zero Hour; (AR) As Received; (AM) - After Maintenance

DR - Deterioration Rate (g/bhp-hr/100,000 miles) After Maintenance
 Same Laboratory, if possible.

SUMMARY
EMISSION RESULTS
EPA-EMA IN-USE EMISSION
TEST PROGRAM
LIGHT HEAVY-DUTY DIESELS
FTP TRANSIENT CYCLE

<u>TEST NO.</u>	<u>MFG</u>	<u>MODEL</u>	<u>MILEAGE</u>	<u>NOx(AR)</u>	<u>HC(AR)</u> G/BHP-HR	<u>Pt(AR)</u>
26	IHC	6.9L	47,516	3.98	1.49	1.45

(AR) - As received, all results per EPA's Motor Vehicle Emission Laboratory Data.

1692C/10

**SUMMARY
EMISSION RESULTS
EPA-EMA IN-USE EMISSION
TEST PROGRAM
MEDIUM HEAVY-DUTY DIESELS
FTP TRANSIENT CYCLE**

<u>TEST NO</u>	<u>MFG</u>	<u>MODEL</u>	<u>MILEAGE</u>	<u>NOx(AR)</u>	<u>NOx(AM)</u>	<u>HC(AR)</u>	<u>HC(AM)</u>	<u>Pt(AR)</u>	<u>Pt(AM)</u>
						G/BHP-HR			
16 long chg 2	CAT	3208	122,000	9.87		1.15		.79	
long blwng 3	IHC	A210F	62,086	7.27	7.36	.98	.70	.86	.71
long accrs 4	IHC	A210F	85,000	8.41	7.94	.72	.66	.85	.61
mod mng 5	IHC	A180F	29,673	7.02	6.68	1.19	.80	.89	.62
mod mng 16	GMC	8.2NA	72,571	7.11	6.83	1.20	1.09	.72	.63
long chg 17	GMC	8.2T	70,000	9.95	5.69	1.01	1.10	.88	.88
mod govern 19	GMC	8.2T	130,000	5.71	5.72	1.34	.77	.69	.74
mod govern 20*	GMC	6V53T	151,105	8.15		3.53		3.47	
mod mng 22	CAT	3208	100,000	18.90	9.74	1.38	1.68	.76	1.15
24	CAT	3208	50,000	8.77		1.01		.62	
25	CAT	3208	25,000	9.01		.93		.60	
mod mng 99	CAT	3208	50,000	8.40		1.96		.92	
				$\bar{x} = 9.05$		1.37		1.00	
Representative Mean x			72,394	9.13		1.17		.78	

*Non-Representative

(AR) - As Received; (AM) - After Maintenance

1692C/11

RADIAN
CORPORATION

**SUMMARY
EMISSION RESULTS
EPA-EMA IN-USE EMISSION
TEST PROGRAM
HEAVY HEAVY-DUTY DIESELS
FTP TRANSIENT CYCLE**

<u>TEST NO</u>	<u>MFG</u>	<u>MODEL</u>	<u>MILEAGE</u>	<u>NOx(AR)</u>	<u>NOx(AM)</u>	<u>HC(AR)</u>	<u>HC(AM)</u>	<u>Pt(AR)</u>	<u>Pt(AM)</u>
1	MACK	ENDT676	285,346	8.31		.67		.47	
6*	MACK	ENDT676	203,185	6.65		.70		1.52	<i>Pt(AM) 1.52</i>
7	GMC	8V92TA	375,000	7.39	8.02	.73	.90	.95	.95
8	CUMM	NTC350	273,796	6.88		1.18		.64	<i>Pt(AM) .64</i>
9	MACK	ETZ675	225,000	7.59		.37		.75	
10	GMC	6V92TA	220,000	7.70	8.29	1.00	.88	.87	.70
11	GMC	6V92TA	410,000	7.64	8.49	.97	.77	1.06	.83
12	MACK	EM6285	194,828	9.61		.57		2.14	
13	CAT	3406	139,000	7.06		.55		.91	
14*	CUMM	NTC400	257,499	7.23		1.02		.58	<i>Pt(AM) and Fuel 1.58</i>
15*	GMC	8V92TA	400,000	7.25		1.16		1.30	
18	CUMM	NTC290	232,784	7.47		1.35		.57	
21*	CUMM	NTC300	266,541	7.71		1.19		.60	
23	GMC	6L71	350,000	6.55	7.56	1.05	.81	2.17	1.53 <i>Pt(AM) 1.53</i>
27	CUMM	NTC400	221,038	8.32		.97		.52	
28	CUMM	NTC300	273,385	6.63	8.83	1.42	.83	.45	.54
29	CUMM	NTC350	95,192	6.27	7.80	3.87	1.00	1.15	.64
30	CUMM	NTC290	294,953	6.62		0.96		0.64	
Representative Mean x				250,490	7.51		1.13		.84

*Non-Representative

(AR) - As Received; AM - After Maintenance

1692C/12



**COMPARISON OF
EMISSION TRANSIENT TEST RESULTS
EMA-EPA IN-USE EMISSION
TEST PROGRAM
ALL HEAVY-DUTY DIESEL ENGINES**

<u>TEST NO</u>	<u>MFG</u>	<u>MODEL</u>	<u>EPA NOx</u>	<u>MFG NOx</u>	<u>DIFF NOx%</u>	<u>EPA HC</u>	<u>MFG HC</u>	<u>DIFF HC%</u>	<u>EPA Pt</u>	<u>MFG Pt</u>	<u>DIFF Pt%</u>
2	CAT	3208	9.87	9.25	-6.3	1.15	1.22	+ 6.1	.79	.67	-15.2
24	CAT	3208	8.77	7.52	-14.2	1.01	1.24	+22.8	.62	.57	- 8.1
8	CUMM	NTC350	6.88	6.85	-0.4	1.18	.98	-16.9	.64	.76	+18.7
14	CUMM	NTC400	7.23	7.67	+6.1	1.02	.59	-42.2	.58	.71	+22.4
18	CUMM	NTC290	7.47	7.68	+2.8	1.35	.76	-43.7	.57	.64	+12.3
21	CUMM	NTC300	7.71	7.66	+0.6	1.19	.86	-27.7	.60	.59	+ 1.7
27	CUMM	NTC400	8.32	9.15	+10.0	.97	.84	-13.4	.52	.63	21.2
28	CUMM	NTC300	6.63	7.43	+12.1	1.42	1.34	- 5.6	.45	.94	108.9
29	CUMM	NTC350	6.27	6.15	-1.9	3.87	3.39	-12.4	1.15	1.30	+13.0
19	GMC	8.2T	5.72	5.36	-6.3	.77	.73	- 5.2	.74	.60	-18.9
3	IHC	A210F	7.27	6.74	-7.3	.98	.73	-25.5	.86	.80	- 7.0
4	IHC	A210F	8.41	-	-	.72	.61	-15.3	.85	.65	-30.6
5	IHC	A180F	7.02	6.06	-6.0	1.19	.84	-29.4	.89	.65	-27.0
26	IHC	6.9L	3.98	4.10	+3.0	1.49	1.17	-21.5	1.45	1.38	- 4.8
1	MACK		8.31	5.91	-28.9	.67	.83	+23.9	.47	.49	+ 4.3
9	MACK	ETZ675	7.59	5.78	-23.8	.37	.75	+102.7	.75	1.22	+62.7

$$\% \text{ Diff} = \frac{\text{Mfg. Value} - \text{EPA Value}}{\text{EPA Value}} \times 100$$

% Range Diff -28.9 to +12.1 -43.7 to +102.7 -30.6 to +108.9

% Mean Diff x -4.12 -5.8 9.4

EPA(AR) - Tested at EPA's Motor Vehicle Emission Laboratory.

MFG(AR) - Tested at Manufacturer's Test Laboratory.



COSTS & MANPOWER REQUIREMENTS
EPA-EMA IN-USE EMISSION
TEST PROGRAM

HEAVY-DUTY DIESEL ENGINES

	REPLACEMENT ENGINE		ADMINISTRATIVE		AVE. TEST HOURS		
	LIST PRICE*		LOCATING & TEST	SETUP-DISMANTLING	FOR VALID	EMISSION RESULTS	
	MEAN <u>(\$/ENGINE)</u>	RANGE <u>(\$/ENGINE)</u>		(MANHRS/ENGINE)** <u>MEAN</u>	<u>RANGE</u>	(HOURS/ENGINE) <u>MEAN</u>	<u>RANGE</u>
LGT-HVY	5,115	3,600- 7,770	43	20-85	30	15-50	
MED-HVY	9,100	6,600-13,621	43	20-85	30	15-50	
HVY-HVY	16,841	11,924-21,122	43	20-85	30	15-50	

*JULY 1985 FIGURES, DOES NOT INCLUDE SHIPPING & INSTALLATION SUPPORT PARTS.

**DOES NOT INCLUDE DEALER & SERVICE PERSONNEL TIME.

PROBLEMS ENCOUNTERED:

1. CUSTOMERS NOT WANTING REPLACEMENT ENGINES IN WORN-OUT TRUCKS.
2. LACK OF GOOD MAINTENANCE RECORDS & DIFFICULTY OBTAINING THE RECORDS.
3. DIFFICULTY LOCATING ENGINE OWNERS FOR NON-OEM TRUCK MANUFACTURERS.
4. EPA RANDOM SELECTION PROCESS FOR ONE MANUFACTURER DID NOT READILY OBTAIN THE DESIRED POWER/RPM COMBINATIONS DUE TO THE SERIAL NUMBER SEQUENCING PREVENTING EASY SELECTIONS BY RATINGS.
5. DESIRED ENGINES SCRAPPED, EXPORTED, AND/OR REBUILT.
6. TAX LIENS, BANKRUPTCIES, OTHER LEGAL PROBLEMS MAKES SOME TRUCKS UNAVAILABLE.
7. EXCESSIVE OWNER DEMANDS EXPERIENCED.
8. PRESSING CUSTOMER USAGE CAUSES DIFFICULTY ARRANGING & SCHEDULING TRUCK AVAILABILITY FOR ENGINE EXCHANGES.

1705C/2

CONCLUSIONS
FROM
EPA-EMA IN-USE EMISSION
TEST PROGRAM
HEAVY-DUTY DIESEL ENGINES

- THE IN-USE CONTROL OF GASEOUS EMISSION FROM HEAVY-DUTY DIESEL ENGINES FROM THIS 1979-80 MODEL YEAR IS DEMONSTRATED TO BE QUITE GOOD.
- TAMPERING AND POOR MAINTENANCE DOES NOT RESULT IN EXCESSIVE GASEOUS EMISSIONS.
- THE LAB-TO-LAB VARIABILITY OF TRANSIENT EMISSION TEST RESULTS OF BOTH UNBURNED HYDROCARBON (HC) AND PARTICULATE (PT) NEEDS TO BE IMPROVED.
- USED IN-SERVICE ENGINE ACQUIREMENT AND TESTING EXPENSIVE.

1692C/14

RADIAN CORPORATION

EPA'S HEAVY-DUTY ENGINE PILOT RECALL PROGRAM

PURPOSE:

- PROCURE, MAINTAIN, TEST, AND RETURN TO OWNER'S A SAMPLE OF HDE ENGINES.
- DEVELOP METHODOLOGY FOR AN OPERATIONAL HDE RECALL PROGRAM.

DESIGN:

- PATTERNED AFTER LDV PROGRAM
- DEVELOP METHODOLOGY
- APPLY METHODOLOGY TO SAMPLE OF IIB HDGES
- REVISE METHODOLOGY

STATUS (AS OF JULY 30, 1985)

- COMPLETED TWO MAILING
 - LOW RESPONSE RATE
 - SOME TRUCKS WITH HIGH MILEAGE/LONG MAINTENANCE
 - ONE ENGINE SELECTED FOR INITIAL PROCESS
 - SECOND ENGINE IN PROCESS
- THIRD MAILING MADE
 - NO RESULTS
- PREPARING TO TEST TWO ENGINES
 - TESTING TO BEGIN MID AUGUST

SUMMARY

RESPONSE TO SWRI MAILINGS CONCERNING THE
PROCUREMENT OF CLASS IIB HDGES

<u>TYPE OF RESPONSE</u>	<u>FIRST 30 MAILING NUMBER OF</u>	<u>NEXT 50 MAILING NUMBER OF</u>	<u>TOTAL MAILING NUMBER/%</u>
NO	9	15	24/30%
YES			
-OK	0	1	1/ 1.25%
-HIGH MILEAGE	0	3	3/ 3.75%
-LONG MAINTENANCE INTERVALS	3	2	5/ 6.25%
NO REPLY/NO PHONE LISTING	9	8	17/21.25%
HIGH MILEAGE	3	7	10/12.5%
ENGINE REPLACED OR MODIFIED	3	3	6/ 7.5%
TRUCK SOLD/WRECKED OR STOLEN	2	9	11/13.75%
WILLING BUT LOANER TRUCK UNSUITABLE	1	2	3/ 3.75%

1692C/16

EPA'S
HEAVY-DUTY ENGINE
RECALL TESTING PROGRAM

PURPOSE:

- TO MINIMIZE THE NUMBER OF IN-USE VEHICLES WITH EMISSION LEVELS ABOVE THE STANDARDS.

DESIGN:

- TEST SAMPLES WILL BE BASED UPON THE ENGINE FAMILY DESIGNATION.
- A REPRESENTATIVE SAMPLE WILL BE SELECTED AFTER SCREENING FOR PROPER MAINTENANCE, USE, AND USEFUL LIFE.
- STATISTICAL AND ENGINEERING ANALYSIS WILL BE USED TO INDICATE WHETHER SUBSTANTIAL NON-COMPLIANCE EXISTS IN POPULATION.

STATUS:

- TO BE INSTITUTED DURING THE 1987 FISCAL YEAR.
- NO ENGINE FAMILIES PRIOR TO 1985 MODEL YEAR TO BE TESTED.
- THE TESTING OF MEDIUM AND HEAVY-HEAVY DUTY DIESEL ENGINES WILL NOT START UNTIL AFTER THE 1988 MODEL YEAR ENGINES ARE IN-USE.

1692C/17

FACTORS AFFECTING ENGINE FAMILY
SELECTION AND PRIORITIZATION

PRODUCTION - (FAMILY SIZE)

CROSS-SECTION OF ENGINE MANUFACTURERS

DEFECT INFORMATION

SIMILARITY IN DESIGN TO OTHER NON-COMFORMING FAMILIES

OTHER EMISSION DATA (ASSEMBLY LINE, EMISSION FACTORS,
ETC.)

ANTICIPATED DIFFERENCES
LIGHT-DUTY VS. HEAVY-DUTY ENGINE
RECALL TESTING

LIGHT-DUTY

TWO-STAGE

SURVEILLANCE
CONFIRMATORY

SAMPLE

FROM IN-USE POPULATION
IN PROXIMITY TO TESTING
LABORATORY

TESTING

EITHER OF TWO LABORATORIES
EGYG (SPRINGFIELD, VA) OR
MVEL (ANN ARBOR, MI)
FEDERAL TEST PROCEDURES-EVAP
EMISSIONS MEASURED AT MVEL

HEAVY-DUTY

SINGLE STAGE

EQUIVALENT TO CONFIRMATORY

SAMPLE

FROM IN-USE POPULATION IN
PROXIMITY TO TESTING
LABORATORY PLUS OTHER
METROPOLITAN LOCATIONS AS
NEEDED.

TESTING

TESTING AT MVEL
CYCLE SAME AS USED TO
CERTIFY ENGINE FAMILY
OTHERWISE FTP

1692C/19

- 1) CONTACT OF OWNER (CARD-TELEPHONE)
 - SCREENING FOR MAINTENANCE AND ABUSE
- 2) PRE-TEST INSPECTION (BEFORE REMOVAL)*
 - LOCATION OF CHECK (OWNER'S LOCATION, REMOVAL FACILITY)
 - DOCUMENT THE CONDITION OF ENGINE AND EMISSION CONTROLS
 - FUNCTIONAL TESTING (COMPRESSION RATIO, ETC.)
- 3) ENGINE REMOVAL*
 - OPTIONS (DEALERS, INDEPENDENT CONTRACTOR, MVEL)
- 4) SHIPMENT TO FACILITY
 - PER MSAPC ADVISORY CIRCULAR 22
- 5) PRE-TEST MAINTENANCE*
 - REPLACE PART'S PER EMISSION MAINTENANCE SCHEDULE
 - ADJUST IDLE PARAMETERS
 - FUNCTIONAL TESTS OF EMISSION CONTROL CONFORMITY

1692C/20

RADIAN
CORPORATION

- 6) TESTING*
 - PER FTP
- 7) RETURN OF ENGINES
 - INSTALLATION

*MANUFACTURER REPRESENTATIVES PRESENT AT THESE STAGES.

1692C/21

-6480
Peoria, Illinois 61629

October 7, 1985

Mr. Christopher S. Weaver
Radian Corporation
10394 Old Placerville Road
Sacramento, CA 95827

Dear Chris:

Enclosed is a summary of the EMA/EPA in-use engine program test results for Caterpillar engines. This data should be the same as that shown on the EMA summary sheets you received in El Monte except that I have deleted transient test data and added smoke test results for two engines. EPA did not run smoke tests on engines tested in their lab.

Also shown for each engine are brief comments on engine component or setting discrepancies found on the returned engines. Our program was planned so that we would only check engines that had performance or emissions significantly different than expected. Only one engine, a 3208 - EMA test no. 22 - had been misadjusted in a manner to have a serious effect on gaseous emissions. For this engine, the advanced timing was probably the greatest contributor to the high NO_x. The 3406 engine, EMA test no. 13, had the fuel rate increased to provide an additional 60 horsepower but gaseous emissions did not increase over the zero mile baseline.

Three of the 3208 engines tested had performance and emissions values comparable to our expectations so no maintenance or inspections were performed on these engines. The one 3208 engine with high lug smoke opacity was checked to determine the condition of the fuel nozzles. One nozzle was found to have a plugged orifice which will result in poor combustion and excessive smoke and the other two did not meet our specifications on the nozzle fuel flow test.

I hope this information will be of help to you in your in-use maintenance study. Please call if you have any questions.

Very truly yours,

Don

Engine Emissions Manager
Product Safety &
Environmental Control G.O.

DCDowdall
Ph: (309) 675-5362
clm/dcd5280900

EMA/EPA IN-USE PROGRAM

CATERPILLAR ENGINES

ENGINE	EMA TEST NO.	MILES	LAB	GASEOUS EMISSIONS - g/hp-hr				% Smoke Opacity		
				TEST	HC	NO _x	PART	"a"	"b"	"c"
3208 DI-NA 210 HP	2	0	CAT	13M	1.01	8.58	6.16	-	13.7	18.6
		0		TIMING ADVANCED FROM 15° TO 16° BEFORE SHIPMENT - NO RETEST						25.5 (1)
		122,000	EPA	13M	.83	7.41	5.83	-	10.3	9.9
		122,000	CAT	13M	1.08	8.59	5.11	-	13.2	16.5
				TIMING RETARDED FROM 16° TO 15° FOR EMISSIONS COMPARISON						22.3
		122,000	CAT	13M	1.20	7.65	5.04	-		
				WITH 0 MILES. NO MAINTENANCE PERFORMED.						
3208 DI-NA 210 HP	99	0	CAT	13M	1.21	8.79	6.16	-	9.2	10.9
		50,000	CAT	13M	1.37	7.84	6.89	-	19.3	19.0
				LOW MILES - HIGH HOURS - AFTER TEST INSPECTION - 3 BAD FUEL NOZZLES						35.8
3208 DI-NA 210 HP	24	0	EPA	13M	-	-	-	-		
		50,000	EPA	13M	.96	8.45	4.72	-		
				NO MAINTENANCE PERFORMED - PERFORMANCE OKAY						
3208 DI-NA 175 HP	22	0	CAT	13M	1.00	8.38	4.47	-		
		100,000	EPA	13M	.75	17.35	11.24	-		
				INSPECTION - TIMING ADVANCED 9° FROM SPEC AND FUEL PUMP						
				SETTING INCREASED TO PROVIDE 16% HIGHER FUEL RATE THAN SPEC.						
				TIMING & FUEL RATE RESET TO Specs. FOR RETEST.						
		100,000	EPA	13M	1.04	8.63	4.16	-		
3208 DI-NA 210 HP	25	0	CAT	13M	-	-	-	-		
		25,000	EPA	13M	.94	7.72	5.91	-		
				NO MAINTENANCE - PERFORMANCE OKAY						
3406 DI-TA 380 HP	13	0	CAT	13M	.39	9.40	2.55	-		
		44,000		BEARING FAILURE - ENGINE REBUILT AND DYNOMETER CHECKED						
		139,000	EPA	13M	.38	7.39	1.95	-		
				POWER HIGH - FUEL RATE 14% ABOVE SPEC - FUEL SYSTEM						
				SET OUT OF SPECS. - TIMING RETARDED 3° FROM SPECS. -						
				SMOKE LIMITER SET TO SPECS. - NO OTHER MAINTENANCE						
				AND NO RETEST.						

Cummins Engine Company, Inc.
RADIAN
Corporation
Columbus, Indiana
47202-3005



March 20, 1986

Mr. Paul Jacobs
Radian Corporation
10395 Old Placerville Rd.
Sacramento, CA 95827

Dear Paul:

Here is the most recent update of the combined Fred (Field Return Engine Determination) and Recap (Random Environmental Compliance Audit Program) summary file. The Fred program was Cummins's own field engine sampling program, whereas the Recap program was initiated by EPA. The name Recap is one we coined. EPA's name for the same program is Diesel Emissions Factors (DEF). Some of the data from earlier summaries has been corrected for errors made in transcribing.

If you have any questions, please contact me.

R. A. Jorgensen/rf

Group Leader -
Emissions Development

812-377-7432

12/20/86 11:01 CROBRAJ JORGENSEN

042262.000002 W00=CTC
CP-6 VERSION CO00 CUMMINS DPS B/70C

CCCCC	RRRRR	00000	88888	RRRRR	AAAAA	JJ
CC CC	RR RR	00 00	88 88	RR AA	AA	JJ
CC CC	RR RR	00 00	88 88	RR AA	AA	JJ
CC CC	RRRRR	00 00	88888	RRRRR	AAAAAA	JJ
CC CC	RRRRR	00 00	88 88	RRRRR	AA AA	JJ
CC CC	RR RR	00 00	88 88	RR AA	AA	JJ
CCCCC	RR RR	00000	88888	RR AA	AA	JJJJJ

JJ	00000	RRRRR	GGGG	EEEEEE	N	NN	SSSSSS	EEEEEE	N	NN
JJ	00 00	RR RR	GG GG	EE EE	NN	NN	SS	EE	NN	NN
JJ	00 00	RR RR	GG GG	EE EE	NNNN	NN	SS	EE	NNNN	NN
JJ	00 00	RRRRR	GG GGGG	EE EE	NN N	NN	SSSSS	EEEEEE	NN N	NN
JJ	00 00	RR RR	GG GG	EE EE	NNNN	NN	SS	EE	NNNN	NN
JJJJJ	00000	RR RR	GGGGG	EEEEEE	NN N	NN	SS	EE	NNNN	NN

00000	44	22222	22222	666666	222222
00 00	444	22 22	22 22	66 66	22 22
00 00	4 44	22	22	66	22
00 00	44 44	22	22	666666	22
00 00	444444	222	222	66 66	222
00 00	44	22	22	66 66	22
00000	44	2222222	2222222	666666	2222222

11:01 FEB 20 '86 FRSUM. CROBRAJ

RADIAN
CORPORATION

PDW 110 ENGINE	TRANSIENT HC PART NOX	SMOKE			13-MODE		COMMENT	ℓ_{NO_x} , ℓ_{NO}
		A	B	C	HC	NOX		
FRED 1 NTC-300 62,644	.76 0.50 6.43 .65 0.43 6.89	7.20 7.12	.64 1.11	9.53 10.56	.29 .26	8.21 8.98	AS RECEIVED AFTER "C"	
FRED 2 NTC-400 190,701	.97 0.78 5.93 .88 0.77 6.50 1.25 0.97 6.46	13.33 11.74 9.89	7.22 4.05 1.87	17.24 15.64 17.50	.36 .29 .37	7.74 7.71 8.47	AS RECEIVED AFTER "C" AFTER "D"	
FRED 3 NTC-300 57,704	1.11 0.70 6.85 1.00 - 6.88	10.49 8.20	2.06 1.39	14.70 10.98	.35 .30	7.53 7.93	AS RECEIVED AFTER "C"	
FRED 4 NTC-300 282,554	.84 0.56 7.29 .69 0.49 7.66 .86 - 6.65	10.57 6.24 11.65	1.09 .63 .97	16.71 10.63 20.34	.27 .27 .39	8.33 9.33 9.33	AS RECEIVED AFTER "C" AFTER "D"	
FRED 5 NTC-400 186,891	.96 0.86 6.19 .58 0.83 6.70 .71 0.69 6.77	29.17 21.02 11.56	5.11 3.59 2.39	37.58 30.36 15.29	.39 .29 .38	8.75 9.39 9.42	AS RECEIVED AFTER "C" AFTER "D"	
FRED 6 NTC-300 89,620	1.59 0.56 6.65 .78 0.48 7.21	7.79 4.53	.92 0.69	10.98 6.60	.34 .26	8.98 9.54	AS RECEIVED AFTER "C"	
FRED 7 NTC-350 252,685	.76 0.76 6.50 .73 0.64 6.30 .89 0.60 6.25	11.88 10.37 11.92	3.70 3.62 2.53	14.87 13.03 16.22	.28 .28 .45	7.97 7.96 8.41	AS RECEIVED AFTER "C" AFTER "D"	
FRED 8 NTC-300 127,446	.67 0.52 7.40 .46 0.66 7.41	8.82 10.16	.71 .56	23.28 25.65	.28 .25	9.57 9.28	AS RECEIVED	
FRED 9 NTC-350 59,187	.71 0.53 6.18 .82 0.59 6.85	6.77 6.87	2.49 2.45	8.28 7.83	.29 .23	7.84 8.48	AS RECEIVED AFTER "C"	
FRED 10 NTC-300 62,766	.93 0.67 6.14 .82 0.49 6.86	17.97 15.00	1.11 1.26	50.13 42.09	.37 .28	7.59 8.20	AS RECEIVED AFTER "C"	

RADIAN
CORPORATION

C.L. Inj. / C.L.										C.L. Inj. / C.L.									
AT EPA					AT EPA					TRANSIENT					13 MODE				
FRED 11	.58	0.50	7.24	6.68	1.81	8.31	.28	10.08	AS RECEIVED										
NTC-300	.65	0.55	7.14	5.43	1.09	6.82	.24	9.31	AFTER "C"										
116,159	.89	0.58	6.91	7.00	.70	8.89	.35	9.19	AFTER "D"										
FRED 12	1.03	1.00	6.50	8.55	1.11	12.57	.31	9.70	AS RECEIVED										
NTC-300																			
316,911	1.16	1.28	8.71	5.18	0.53	8.57	.32	11.05	AFTER "C"										
FRED 13	.59	0.40	7.49	5.41	0.45	9.73	.26	9.22	AS RECEIVED										
NTC-300	.50	0.34	7.93	6.85	0.53	13.13	.25	9.33	AFTER "C"										
215,861	1.15	0.46	7.35	5.52	0.81	9.46	.33	9.17	AFTER "D"										
FRED 14	.80	0.73	7.16	42.4	8.1	74.3	.37	6.99	AS REC'D OUT										
	1.15	0.93	7.28						AS REC'D IN	1.49	0.74	7.30							
NTC-350	.46	0.48	8.13	28.5	5.3	58.3			AFTER "C"										
408,549	1.09	0.49	7.34	14.7	4.6	29.4			AFTER "D"										
RECAP 1	.98	0.76	6.85	18.93	6.60	21.26	.32	8.81	AS RECEIVED										
									O IDLE LOAD	1.18	0.64	6.88	.26	D	7.58	D			
NTC-350	.76	0.61	8.23	10.98	5.75	12.54	.22	10.30											
27B,20B	1.08	0.50	7.64	10.82	3.44	12.07	.27	9.34											
RECAP 2	.55	0.64	7.76	35.6	4.0	64.4	.21	9.88	AS RECEIVED										
	.59	0.71	7.67						O IDLE LOAD	1.02	0.58	7.23	.31	D	9.14	D			
NTC-400	.55	1.20	8.09	52.8	8.8	81.7			AFTER "C"										
257,449	.89	0.97	6.52	15.0	7.8	17.6			AFTER "D"										
RECAP 3	.74	0.61	7.59	15.4	3.5	18.8	.25D	8.05D	AS RECEIVED										
	.76	0.64	7.69						O IDLE LOAD	1.35	0.57	7.47	.32	D	9.08	D			
NTC-290									AFTER "C"										
232,784	.64	0.56	8.38	10.6	2.9	13.3													
RECAP 4	.85	0.54	7.21	9.16	0.80	13.90	.67	9.58	AS RECEIVED										
	.86	0.59	7.66						O IDLE LOAD	1.19	0.60	7.71	1.11D	9.24	L				
NTC-300									AFTER "C"										
264,021	.87	0.52	7.32	5.59	0.80	8.42	.61	9.27	AS REC'D OUT										
RECAP 5	.71	0.58	9.10	32.10	4.90	55.70			AS REC'D OUT										
	.77	0.62	9.01						AS REC'D IN										
NTC-400	.84	0.63	9.15						O IDLE LOAD	0.97	0.52	8.32	.35	D	10.4	D			
221,038	1.38	0.89	7.55	35.9	4.4	62.1			AFTER "C"										
	1.03	0.64	7.19	16.9	4.9	29.8			AFTER "D"										
RECAP 6	1.42	0.72	7.53	11.7	2.0	21.2			AS REC'D OUT										
	1.49	0.94	7.43	11.2	2.3	20.8			O IDLE LOAD	1.42	0.45	6.63	.49	D	8.02	D			

*** TRANSIENT VARIES = 1 / Z*(CON_0) + A / Z*(HOT) ***

Cummins Engine Company, Inc.Box 3005
Columbus, Indiana 47202-3005 Telephone 377 5000

June 3, 1986

Mr. Chris Weaver
Radian Corporation
10395 Old Placerville Road
Sacramento, CA 95827

Dear Chris:

The following data show the effect of fuel pump setting on particulate and gaseous emissions. The fuel pump AFC settings were adjusted to provide a range of accel smoke levels over the federal smoke cycle and show a pronounced effect on transient particulate levels.

I hope this data is useful in your study.

<u>Smoke-%</u>			<u>g/BHP-hr</u>			
<u>A</u>	<u>B</u>	<u>C</u>	<u>HC</u>	<u>CO</u>	<u>NO_X</u>	<u>PART.</u>
8.4	2.8	10.1	.95	1.69	5.49	.53
15.3	2.5	23.4	.87	2.75	5.54	.57
23.8	2.6	49.9	.87	3.55	5.58	.63
38.7	2.6	85.9	.51	5.90	5.45	.80

Federal smoke values

A = Accel
B = Lugdown
C = Peak

Sincerely,

L.C.Broering
Technical Advisor
Product Environmental
Management

L.C.Broering/bm

cc: P. A. Gustafson



Environmental Activities Staff
General Motors Corporation
General Motors Technical Center
30400 Mound Road
Warren, Michigan 48090-9015

October 21, 1985

Mr. Christopher S. Weaver, P. E.
Project Director
Radian Corporation
10395 Old Placerville Rd.
Sacramento, California 95827

Dear Mr. Weaver:

This is in response to your October 2nd telephone inquiry to Mr. Harry Schwochert asking that we supply you with a description of the maintenance performed on the DDAD engines included in the EPA/EMA in-use emissions study.

The information you requested is attached. The observations made were based on what could be seen or checked as part of a readjustment type of tune-up. Except as noted below, no checks were made to determine if the engines had the correct camshafts, pistons and compression ratio. In addition, the aftermarket injectors found on certain engines were not tested to determine if they were equivalent to original equipment injectors.

We were informed that the cylinder heads on the 8V-92TA engine No. 8VF36915 had been replaced. Inspection of this engine showed that the engine had been improperly rebuilt. During this inspection it was also noted that the engine was equipped with the correct camshafts.

If you have any questions on this information, please contact either Harry Schwochert or me.

Your October 4th letter to Harry Schwochert requesting information on tampering and improper maintenance of DDA engines in customer use has just been received. We have asked DDAD for any information it may have on these two items and will contact you when we receive a response from DDAD.

Yours truly,

James B. Feiten
Automotive Emission Control

Attachment



cc: H. W. Schwochert



DETROIT DIESEL ALLISON DIVISION, GMC

MAINTENANCE PERFORMED ON
IN-USE EMISSION TEST ENGINES

6V-92TA ENGINE FAMILY:

ENGINE SERIAL NO. 6VF49834: THE VALVE BRIDGE FOR CYLINDER NO. 2L WAS MISALIGNED SO THAT ONLY TWO VALVES WERE OPERATING. THE VALVE BRIDGE WAS REPLACED. INJECTOR TIMING WAS APPROXIMATELY ONE DEGREE RETARDED - RESET. EXHAUST VALVE LASH AND THROTTLE DELAY SETTING WERE READJUSTED. THE BLOWER INLET GASKET WAS LEAKING. WHEN THE GASKET WAS REPLACED, MOST OF THE INLET HOUSING TO BLOWER BOLTS WERE FOUND TO BE ONLY FINGER TIGHT. THE ENGINE WAS EQUIPPED WITH AFTERMARKET (NON-DDA) INJECTORS AND THE INJECTOR CONTROL RACKS WERE LOOSE. THE RACKS WERE READJUSTED , BUT THE INJECTORS WERE NOT REPLACED.

ENGINE SERIAL NO. 6VF52752: ENGINE WAS LOW ON POWER. ENGINE CONSTANT POWER GOVERNOR WAS SET FOR FULL POWER OPERATION. GOVERNOR WAS RESET TO 270 BHP @ 1900 RPM. VALVE LASH AND THROTTLE DELAY SETTINGS WERE OUT OF ADJUSTMENT - RESET. ONE INJECTOR WAS OUT OF ADJUSTMENT AND WAS RESET. AFTER TUNE-UP ENGINE WAS STILL LOW ON POWER.

8V-92TA ENGINE FAMILY:

ENGINE SERIAL NO. 8VF44827: ENGINE HAD NO THROTTLE DELAY PISTON; A NEW THROTTLE DELAY WAS INSTALLED. INJECTOR TIMING WAS APPROXIMATELY TWO DEGREES RETARDED - RESET. VALVE LASH WAS CHECKED AND RESET AS REQUIRED. ENGINE HAD AFTER MARKET INJECTORS; THEY WERE NOT REPLACED. RACKS WERE LOOSE AND RESET.

ENGINE SERIAL NO. 8VF36915: ENGINE NOT REPRESENTATIVE. REBUILT WITH WRONG INJECTORS (9290'S INSTEAD OF 9A90'S). WRONG TURBOCHARGER AND CYLINDER LINERS. NO THROTTLE DELAY. WAS REBUILT AT A SHOP WHICH IS NOT AFFILIATED WITH DDA. ENGINE HAD BEEN EQUIPPED WITH A JAKE BRAKE (COMPRESSION BRAKING SYSTEM). THIS WAS PULLED AND INSTALLED ON SWAP ENGINE, SO THE OVERHEAD WAS NOT IN AN AS RUN CONDITION.

6L-71N ENGINE FAMILY:

ENGINE SERIAL NO. 6A385168: ENGINE GOVERNOR WAS OUT OF ADJUSTMENT, NO LOAD SPEED APPROXIMATELY 400 RPM TOO HIGH. ENGINE POWER WAS LOW THROUGHOUT SPEED RANGE. INJECTORS WERE ONE TO TWO DEGREES RETARDED. VALVE ADJUSTMENT RESET AS REQUIRED. AFTER ENGINE TUNE-UP WAS PERFORMED, POWER REMAINED LOW (198 VS. 230 RATED), POSSIBLY DUE TO INJECTORS WHICH APPEARED TO BE ORIGINAL EQUIPMENT.

V8-8.2 ENGINE FAMILY:

ENGINE SERIAL NO. 8G18174: INJECTOR TIMING WAS WITHIN TOLERANCE. VALVE LASH WAS CHECKED AND RESET WHERE REQUIRED. INJECTOR CONTROL RACKS WERE FOUND TO BE SET TIGHT AND WERE RESET.

V8-8.2T ENGINE FAMILY:

ENGINE SERIAL NO. 8G12607: INJECTORS WERE APPROXIMATELY ONE MM OUT OF ADJUSTMENT (ABOUT SIX DEGRES ADVANCED) AND WERE RESET. VALVE LASH WAS RESET. IDLE SPEED WAS 912 RPM - RESET.

ENGINE SERIAL NO. 8G21671: INJECTOR TIMING WAS GOOD. VALVE LASH WAS RESET WHERE REQUIRED. THE GOVERNOR GAP, RACK ADJUSTMENT AND IDLE SPEED WERE ALSO RESET.

6V-53T ENGINE FAMILY:

ENGINE SERIAL NO. 6D197280: ENGINE WAS LOW ON POWER AND FUELING WHEN RECEIVED. BOTH VALVE LASH AND INJECTOR TIMING WERE OUT OF ADJUSTMENT AND WERE RESET (INJECTORS WERE ADVANCED APPROXIMATELY TWO TO THREE DEGREES). INJECTOR CONTROL RACKS WERE OUT OF ADJUSTMENT - RESET. ENGINE WAS STILL LOW ON POWER AND FUELING. INJECTORS WERE REPLACED. ENGINE REMAINED LOW ON POWER. AFTER THE ENGINE WAS RETURNED FROM EPA, THE ENGINE WAS PARTIALLY DISASSEMBLED AND THE FIRE RINGS WERE FOUND TO BE COLLAPSED. THE FUEL FILTER APPEARED TO BE ORIGINAL EQUIPMENT. THE INJECTORS WERE REMOVED AND FOUND TO BE HEAVILY CARBONED DESPITE HAVING ONLY A FEW HOURS OF OPERATION ON THEM. THEY WERE CALIBRATED AND FOUND TO BE WITHIN TOLERANCE.



May 23, 1986

Mr. Chris Weaver
Radian Corporation
10395 Old Placerville Road
Sacramento, CA 95827



INTERNATIONAL

Dear Mr. Weaver:

For your reference, I have modified the letter I sent to you on November 17, 1985 to include brake specific fuel consumption (BSFC) taken by fuel measurement during the transient emission cycle. These values are from weighted cold and hot cycles from before and after maintenance engine conditions. Emissions are given in g/bhp-hr and BSFC is in lb/bhp-hr.

EPA Test No.: 3
Family/Model: DT-466/A21OF S/N 97500
Mfg. Date: 6-20-79
Applications: Dump/Street Repair/Snow Removal
In-Use Miles: 62086
Engine Hrs.: 2,743
Inspection As Received: High crankcase blow-by noted, but a subsequent oil consumption test showed normal oil consumption. No injection timing change or pump tampering noted.

		EPA	IH
As Received Results:	HC	.98	.73
	NOx	7.27	6.74
	Part.	.86	.80
	CO	2.77	-
	BSFC		.499

- Maintenance Performed:
1. Cleaned crankcase breather element.
 2. Nozzle Check: Cleaned, three leakers repaired, valve opening pressure reset to specifications (VOP reset by 500 to 1,150 psi).
 3. Valve lash reset by .009 - .016" Intake .009 - .035" Exhaust (#4 exhaust cam lobe worn by .211" lift).

RADIAN
CORPORATION

Results After Maintenance:

By IH Lab

HC	.70
NOx	7.36
Part.	.71
BSFC	.490

EPA Test No.: 4

Family/Model: DT-466/A210F S/N 98515

Mfg. Date: 7-16-79

Application: Tractor Pick-up and Delivery

In-Use Miles: 85,000

Engine Hrs.: 2,395

Inspection As Received: Tag wire corroded, but no tampering indicated based on flow and timing checks.

As Received Trans Results:

	<u>EPA</u>	<u>IH</u>
HC	0.71	.61
NOx	8.41	NA
Part.	.85	.59
CO	3.60	-
BSFC		.497

- Maintenance Performed:
1. Nozzle Check - cleaned, VOP reset by 500-600 psi increase, #6 leak repaired.
 2. Lash reset, intake reduced by .004 to .016", exhaust reduced by .009 to .023".
 3. Changed oil, oil filter, and fuel filter.
 4. Cleaned crankcase breather filter element.

Transient Results After Maintenance:

By IH Lab

HC	.66
NOx	7.94
Part.	.61
BSFC	.490

EPA Test No.: 5

Family/Model: DT-466/A180F S/N 90234

Mfg. Date: 4-10-79

Application: Bulk Carrier - Grain Hauler

In-Use Miles: 29,673

Engine Hrs.: 2,287

Inspection As Received: Tag wires in place - no tampering detected.

As Received Trans Results:

	<u>EPA</u>	<u>IH</u>
HC	1.19	.84
NOx	7.02	6.60
Part.	.89	.65
BSFC		.497

RADIAN
CORPORATION

- Maintenance Performed:
1. Nozzle check - cleaned and VOP reset by 525 to 575 psi increase.
 2. Valve lash reset to specifications (change not recorded).
 3. Cleaned crankcase breather tube.

Transient Results After Maintenance:

By IH Lab

HC	.80
NOx	6.68
Part.	.62
BSFC	.494

EPA Test No.: 26

Family/Model: 6.9LD/B175 S/N 76798

Mfg. Date: 12-14-83

Application: Line Haul

In-Use Miles: 47516

Engine Hrs.: NA

Inspection As Received: No tampering indicated.

As Received Trans Results:

	<u>EPA</u>	<u>IH</u>
HC	1.49	1.17
NOx	3.98	4.10
Part.	1.45	1.38
CO	4.09	-

Maintenance Performed: None

Sincerely,

Ed Sienicki

E. J. Sienicki

EJS:ch/2438C



APPENDIX C

Questions for the Diesel Rebuild Study

RADIAN CORPORATION

EXCESS EMISSIONS DUE TO MAINTENANCE PROBLEMS

As a person familiar with trucks and maintenance practices, you probably have a good idea of how common different kinds of problems are in the industry. The following are some problems that can cause increased smoke and pollutant emissions from diesel engines. Please tell us how common you think each kind of problem is by writing in the space provided the percentage of trucks on the road that you think have this problem. If you aren't sure about the answer, but you can make a reasonable guess, please check the box corresponding to your guess. If you don't have any idea at all how common this problem is, please leave the space blank.

There are spaces for three answers for each question, one for line-haul trucks (trucks used for hauling freight between cities), one for all other types of trucks with turbocharged engines, and one for trucks with naturally aspirated (non-turbocharged) engines. Please answer the questions separately for each type of truck. Some questions do not apply to naturally aspirated engines. These questions have spaces for only two answers for each question.

27. Smoking due to maximum fuel level set higher than manufacturer's spec (or larger-than-standard injectors used on Detroit Diesel Engines).

Percent of trucks with problem.

Line Haul _____ Other Turbocharged _____ Naturally Aspirated _____

28. Fuel injection timing advanced from manufacturer's spec to increase power or fuel economy.

Percent of trucks with problem.

Line Haul _____ Other Turbocharged _____ Naturally Aspirated _____

29. Fuel injection timing retarded from manufacturer's spec (resulting in excess smoke).

Percent of trucks with problem.

Line Haul _____ Other Turbocharged _____ Naturally Aspirated _____

30. Air filter (or blower inlet screen) dirty or clogged enough to cause excess smoke.

Percent of trucks with problem.

Line Haul _____ Other Turbocharged _____ Naturally Aspirated _____

31. Pressure leaks in the inlet air or exhaust piping, causing loss of boost and excessive smoke.

Percent of trucks with problem.

Line Haul _____ Other Turbocharged _____

32. Intercooler clogged or corroded, causing loss of boost and excessive smoke (please answer this question for the percentage of trucks with intercoolers having this problem).

Percent of trucks with problem.

Line Haul _____ Other Turbocharged _____

33. Turbocharger worn or defective, causing loss of boost and excessive smoke.

Percent of trucks with problem.

Line Haul _____ Other Turbocharged _____

34. Turbocharger replaced with a non-standard type.

Percent of trucks with problem.

Line Haul _____ Other Turbocharged _____

35. "Smoke limiter" -- anaeroid or throttle delay -- disconnected, resulting in excess smoke.

Percent of trucks with problem.

Line Haul _____ Other Turbocharged _____

36. "Smoke limiter" reset to allow faster acceleration, resulting in excess smoke.

Percent of trucks with problem.

Line Haul _____ Other Turbocharged _____

37. Fuel injectors worn or clogged enough to cause excess smoke.

Percent of trucks with problem.

Line Haul _____ Other Turbocharged _____ Naturally Aspirated _____

38. Excessive backpressure due to exhaust system deterioration or alterations, resulting in excessive smoke.

Percent of trucks with problem.

Line Haul _____ Other Turbocharged _____ Naturally Aspirated _____

Are there any other maintenance or tampering-related problems that you know of that could cause excess emissions in heavy-duty diesel engines? Please list them below. Please tell us how common you think these problems are.

Do you have any other comments or information about this subject that you would like to add?
